# DISSERTATION ABSTRACTS

ABSTRACTS OF DISSERTATIONS AND MONOGRAPHS IN MICROFORM

UNIVERSITY MICROFILMS, INC. ANN ARBOR, MICHIGAN, 1959



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UNIVERSITY MICROFILMS, INC. ANN ARBOR, MICHIGAN: 1959

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#### AGRICULTURE

## AGRICULTURE, GENERAL

## PROBLEMS OF PRIVATE LAND USE FOR RECREATION IN WISCONSIN.

(L. C. Card No. Mic 59-3165)

Raymond Lloyd Anderson, Ph.D. University of Wisconsin, 1959

Supervisor: Professor C. W. Loomer

#### Problem

Recreation is the most important use of land in much of northern Wisconsin. It is the most promising alternative in an area that has limited economic opportunities. The expected increase in population, levels of living, amount of leisure time, will result in an increased demand for recreational resources. Yet very little is known about the use of recreational lands or the recreation industry. In order to assess northern Wisconsin's potential ability to meet the expected increased demand, present recreational development must be examined and the problems, current and anticipated, must be defined.

#### Method of Analysis

This investigation makes an intensive study of the land use around three typical lakes to determine the extent and type of development, and the problems encountered in recreational land use. The owners of summer homes on these lakes supplied data on non-commercial recreation development. Resorts in Sawyer county were sampled to obtain information on the resort industry. Insight into problems of public recreational land use was gained by interviewing county officials and local people. The land use around lakes was mapped and ownership of land around lakes was determined from tax records. Personal observation of the lakes during the summer yielded information on recreational use problems.

## Findings

Approximately one half of the shoreline on the lakes studied is presently used for summer homes and resorts. This does not mean that recreational resources are only half utilized. Some shoreline is unsuitable for intensive recreational use, other areas could be used more intensively. Larger water areas will support more intensive riparian development. Water use problems are mostly concerned with motor boats on lakes. Motor boats are more of a problem on smaller lakes. Interests of fishermen and boaters conflict.

Resorts in this area are generally small and not very productive. Housekeeping resorts averaged only five cabins per resort. The vacation season is only 10 to 12 weeks in length; rental rates are low so that over half of the resorts have gross incomes of less than \$3,000. The

low income problem of resorts is complicated by the long off-season during which there is a lack of outside employment for resort operators. Many resort operators are retired people or individuals who spend the winter in large cities at other jobs.

Tax levies on recreational property have increased about 400% in the past 15 years. Schools are the chief users of tax revenue in these counties and they are a government service that does not benefit most recreation property owners. Inequities occur because of clustering of property assessments around a central figure and because summer residents are charged with schools they do not use

Very few public recreational use areas exist in the region covered by this study. Public beaches and access points to lakes are scarce, unimproved and unmarked. No organized effort has been made to provide recreational areas for summer visitors.

There is almost no control over development of new subdivisions for summer homes. Developers of summer home sites do not follow state platting regulations in most cases. There is a lack of zoning control by local government units to protect and preserve the recreational resources of the region.

## Conclusions

More research into recreational resource use in northern Wisconsin is necessary, but it is apparent that there is room for considerable expansion of recreational development. Efforts should be made to make the resort business more profitable by enlarging resorts and providing off-season job opportunities for resort operators.

The burden of taxation on recreational property should be lessened by finding some means of supporting schools other than by heavy taxation on recreational property.

Land use problems center around the lack of control and guidance of recreational development. Local units of government should revise and enforce zoning ordinances which will guide and protect the recreational resources. Platting regulations should be revised and enforced to develop meaningful control over lakeshore subdivisions.

Microfilm \$2.55; Xerox \$8.80. 195 pages.

ORGANIZATIONAL AND OPERATIONAL PROCEDURES
OF EXTENSION PROGRAM ADVISORY COUNCILS,
CHARACTERISTICS OF COUNCIL MEMBERS
AND THEIR APPRAISAL OF THEIR COUNCIL
OPERATION, IN SELECTED COUNTIES
IN OREGON AND COLORADO.

(L. C. Card No. Mic 59-3238)

Gordon Lynn Beckstrand, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Gale L. VandeBerg

#### Purpose

The major purpose of this study was to provide information that would be useful to Extension agents and supervisory staffs in Oregon and Colorado in understanding council operation and in developing future plans and procedures in working with councils. Thus, the research objectives were to ascertain:

- 1. The characteristics of council members in these two states.
- 2. The degree to which various organizational and operational procedures were being followed.
- The relative importance of various council functions and the degree to which they were being performed as perceived by council members, county staffs, and supervisory staffs.
- 4. The degree to which council members were satisfied with various council organizational and operational procedures.
- Whether or not there was a relationship between individual characteristics of council members and procedures followed, and members' over-all satisfaction with their councils.

#### Procedure:

Data were collected from 110 advisory council members and 35 county Extension workers in eleven counties in Oregon and Colorado. Also included were 15 state supervisory personnel in these same two states.

Selection of counties was based on types of farming, geographical location within the state, and the degree of participation of advisory councils in program planning in 1957. Personal interviews were conducted with the respondents by the author.

## Summary and Conclusions:

- 1. Generally, these council members were not very representative of the county population of the eleven counties to which they were related.
- 2. Members were not being adequately informed of their responsibilities.
- 3. Members' assignments were generally not well defined.
- 4. Even though generally recommended practices were generally being followed, much improvement could be made by these councils in carrying out the practices to make the councils more effective in planning.
- 5. Characteristics of council members included in this study were not highly associated with council members' over-all satisfaction with their councils. Characteristics that seemed to be associated to some degree with

members' over-all satisfaction with their councils included: (1) age; (2) sex; (3) education; (4) size of farm; and (5) frequency of members' association with county Extension programs. There appeared to be no relationship between the individual council procedures studied and over-all satisfaction of members with their councils. The writer has concluded that other factors might have greater influence than those studied. These include: (1) the personal and social interaction of the members within the councils; and (2) the Extension agent's competency in working with councils and influencing council organization and operation.

6. There was a higher degree of consensus between agents and supervisors in this study, as to the way they perceived importance and performance of council functions, than between members and agents or members and supervisors. Members and supervisors had the lowest degree of consensus.

Microfilm \$2.80; Xerox \$9.60. 214 pages.

## THE ROLE OF THE COOPERATIVE EXTENSION SERVICE IN ALASKA.

(L. C. Card No. Mic 59-3244)

Arthur Stephen Buswell, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Robert C. Clark

The objectives of this study were: (1) to determine what certain groups of people in Alaska perceived as the present and future roles of the Cooperative Extension Service with respect to purposes, functions, activities, subject matter areas, ways of reaching people and clientele; (2) to determine the relationship, if any, of certain demographic factors of respondents to their perception of various aspects of the role of Extension in Alaska; (3) to present certain basic economic, educational, social and political data, and judgments of persons in selected groups concerning the present and future roles of Extension in Alaska, as a partial basis for establishing general and specific objectives of the Service.

Persons included in the study were members of the following groups in Alaska: Extension Service staff; district Extension Service advisory committees; 4-H and homemaker council members; and staffs of closely associated Federal and state agencies.

Data were collected by personal and group interviews in late summer of 1958. Information from 196 respondents was analyzed and the following conclusions were formulated:

- 1. The major purposes of Extension were: (a) disseminating information and teaching skills in the fields of agriculture and home economics, and (b) aiding in the development of youth. Other purposes receiving less emphasis were: family living, marketing, farm and home management, leadership in public affairs, community services and representing University of Alaska and United States Department of Agriculture locally.
- 2. Providing information on specific problems and practices was the function which was receiving, and should continue to receive, most emphasis by Extension.

3. The Extension activity which was receiving, and should continue to receive, the most emphasis was providing information directly to people in Alaska.

4. Family living was the subject matter area currently receiving most emphasis by Extension. Youth development was the area that should receive most emphasis by Extension in the future.

5. Mass communications was the method of reaching people which was receiving, and should continue to receive, most emphasis by Extension.

6. Extension's clientele which was receiving, and should continue to receive, most emphasis was homesteader and farm families.

7. There should be increased effort by Extension to serve more adequately the people of Alaska.

8. There is need for closer cooperation between agencies directly concerned with agriculture and rural life in Alaska in planning and executing their programs.

9. Persons most closely associated with Extension in a professional or voluntary capacity appeared to be best informed about the purposes and activities of the Service.

The following recommendations were developed:

1. A statement of the general and specific objectives of the Cooperative Extension Service in Alaska should be developed for the guidance of the staff and for use in an educational program aimed at better informing advisory committee members, University of Alaska faculty and members of the state legislature of the purposes, program and clientele of the Service.

2. Extension should place major emphasis on: (a) providing information related directly to agriculture and home economics; (b) teaching principles of farm and home management for individual families; (c) helping identify and provide training experiences for lay leaders; (d) assisting other agencies in developing broad programs affecting agriculture and rural life.

3. Extension information should be available to all Alaskans; however, Extension should devote major emphasis to farm, homestead and isolated village residents.

4. Extension should further develop and make more effective use of all methods of reaching people in disseminating its information.

5. Major effort should be devoted to the further development, training and use of district advisory committees so they will be more effective in helping Extension develop programs in local areas.

Microfilm \$3.75; Xerox \$12.80. 291 pages.

EFFECT OF RAW OR STEAMED CORN DIETS WITH OR WITHOUT CERTAIN ADDITIVES ON RUMEN VOLATILE FATTY ACIDS AND RUMEN MICROBIAL DISSIMILATION OF RADIOACTIVE GLUCOSE.

(L. C. Card No. Mic 59-3014)

Alfonso Napalang Eusebio, Ph.D. University of Maryland, 1959

Supervisor: Professor J. C. Shaw

Five Holstein heifers were used in three subdivided feeding periods to study the effects of raw or steamed

corn, with or without supplementation, on the levels of rumen volatile fatty acids and on the <u>in vitro</u> dissimilation of uniformly labeled glucose-C<sup>14</sup> by four-hour incubations of rumen fluid. Information was also obtained on whether the changes in the molar proportions of these rumen acids can be used to predict the heat increment of a feedstuff for ruminants. The diets fed the animals daily during the experimental periods were: Period Ia (42 days), 12.9 lb. alfalfa hay and 5.7 lb. corn meal; Period Ib (14 days), 13.3 lb. alfalfa hay and 5.9 lb. corn meal; Period IIa (42 days), 11.8 lb. corn meal; Period IIb (15 days), 12.0 lb. corn meal; Period IIIa (28 days), 12.4 lb. flaked (steamed) corn; and Period IIIb (28 days), 9.7 lb. flaked corn and 3.3 lb. linseed oil meal. The daily rations during Periods IIb, IIIa and IIIb were supplemented with a commercial mineral mixture at the rate of 1.2 lb. per 100 lb. of feed. In all cases the net energy intake was calculated and adjusted to 110% of a recommended allowance based on the average weight of the animals for each feeding period. Samples of rumen ingesta for volatile fatty acid analyses and dissimilation studies were obtained, by means of the stomach tube technique, 2-3 hours after the morning feeding at the termination of each feeding period.

After the animals had been changed from a normal diet of hay plus corn to diets consisting solely of corn, corn plus minerals, or flaked corn plus minerals with or without added linseed oil meal, the molar proportions of acetic and propionic acids varied inversely; acetic acid decreased by approximately 35 - 42 per cent while propionic acid increased 45 - 104 per cent. Butyric acid decreased slightly on diets of corn or corn plus minerals in contrast to the marked decrease of this acid on the flaked corn-mineral diet. However, when linseed oil meal was added to the flaked corn-mineral diet the level of butyric acid returned to slightly above the values obtained on the normal hay-corn diets. No appreciable changes were observed in the molar percentages of valeric acid throughout the experimental periods. Similar results were noted on the "higher acids" (C6 and above) over the same periods, except for marked increases of these acids on the flaked corn-mineral diets with or without addition of linseed oil meal.

In general the incorporation of glucose carbon into acetic, propionic, butyric, and valeric acids, by the in vitro dissimilations of uniformly labeled glucose-C<sup>14</sup>, was proportional to the molar concentrations in which these acids were found in the rumen fluid. Little incorporation was noted in the higher acids, although their molar percentages in the rumen fluid increased by several fold, notably on diets of flaked corn plus minerals with or without added linseed oil meal. This strongly suggests that the higher acids are not synthesized by the rumen microorganisms from simple carbohydrates such as glucose, but presumably from the more complex polysaccharides contained in the flaked corn portions of the diets.

The low ratios of acetic to propionic acid in the rumen fluid of animals on all-corn diets indicate, in the light of the studies by Forbes et al, that the apparent digestibility of a feedstuff is not necessarily related to the proportions of the volatile fatty acids produced therefrom in the rumen. Likewise it is concluded that the high heat increment noted by Forbes et al. in steers fed an all-corn diet cannot be explained on the basis of the proportions of the volatile fatty acids produced in the rumen. This emphasizes the importance of further studies on the relationship

of rumen volatile fatty acids to the net energy values of feedstuffs and rations.

Microfilm \$2.00; Xerox \$4.20. 76 pages.

# MOVEMENT OF SOIL WATER AS INFERRED FROM MOISTURE CONTENT MEASUREMENTS BY GAMMA RAY ABSORPTION.

(L. C. Card No. Mic 59-3152)

Albert Hayden Ferguson, Ph.D. State College of Washington, 1959

An attempt was made to measure the moisture content in a small volume of soil by  $\gamma$ -ray absorption. The data obtained were used to compare two mathematical approaches of describing unsaturated moisture flow in soils: the diffusion approach in which moisture flow is considered as a resultant of the gradient of the moisture concentration alone and the potential approach which attributes moisture flow to the gradient of the moisture potential.

The  $\gamma$ -ray absorption process appears to be a promising method of studying unsaturated soil moisture flow providing the soil does not swell as water is applied. Moisture contents in a volume of soil 1 cm wide were measured to an accuracy of about  $\pm$  0.5% without disturbing the soil system.

The results were inconclusive in that the same data which indicated that flow was a function of only the moisture content and the moving force were used to show that water movement in homogeneous soils may also be a function of distance to a wetted-front. It appears, however, that the diffusion equation, in which flow is considered to be a function of only the moisture content and the gradient of moisture concentration, may be very useful in approximating unsaturated moisture flow providing the functional dependence of the diffusion coefficient upon the moisture content is known. The relationship between the diffusion coefficient and moisture content does not appear to be a simple one.

The  $\gamma$ -ray absorption method of measuring soil moisture proved especially valuable in the study of water movement in nonhomogeneous systems. It was found that diffusion theory was not applicable in nonhomogeneous systems and that the force causing water movement must be the potential gradient.

Microfilm \$2.00; Xerox \$3.60. 64 pages.

## PHOSPHATE AND SILICATE WEATHERING DURING SOIL FORMATION.

(L. C. Card No. Mic 59-3190)

Rollin Copper Glenn, Ph. D. University of Wisconsin, 1959

Supervisor: Professor Marion L. Jackson

The distribution of mineral compounds in soils is governed by the nature and intensity of the chemical and biotic

factors of soil formation. In this research, transformations of calcium phosphate to aluminum, iron, occluded, and organic forms were studied in relation to the influence of Forest and Prairie vegetation, and the intensity of leaching as a function of depth in soils derived from deep calcareous Peorian loess. The transformations of silicates were also studied in a Prairie soil as a function of chemical weathering of calcareous loessial parent material.

Improvement of the system for fractionating soil phosphates involved studies of the solubility of soil calcium phosphate in 0.5 N ammonium fluoride of pH 8.5, the time of extraction of iron phosphate by 0.1 N sodium hydroxide, extraction of occluded phosphate by 0.5 N sulfuric acid, and the solubility of aluminum phosphate in dithionite-citrate reagent. The improved methods were used to fractionate the phosphates in six Wisconsin soils. Silicate minerals of a deep Prairie soil were investigated using specific surface determinations, differential dissolution analyses, elemental analyses, and x-ray diffraction techniques. The results are summarized as follows:

First. Soil calcium phosphates are relatively insoluble in ammonium fluoride of pH 8.5. A complete extraction of iron phosphate from soils by sodium hydroxide is accomplished in about a nine-hour period. Appreciable amounts of occluded phosphate are dissolved in 0.5 N sulfuric acid which makes it necessary to extract occluded phosphate from soils before using this acid extractant to remove calcium phosphate. The amount of organic phosphorus co-extracted with occluded phosphate in soils of high organic matter content is sufficient to warrant removal of the organic phosphorus from the extracts by charcoal filtration before occluded phosphorus is determined. Aluminum phosphate in soils is sufficiently soluble in dithionite-citrate reagent to prevent a discrete fractionation of occluded aluminum phosphate.

Second. Organic phosphorus in the surface horizon of three Prairie soils comprised 72 per cent of the total phosphorus. In the surface horizon of three Gray-Brown Podzolic soils the organic phosphorus content was 57 per cent of the total phosphorus. Both Prairie and Gray-Brown Podzolic soils contained less than 6 per cent of the total phosphorus in the upper 25 inches in the calcium phosphate form although calcium phosphate was predominent in the parent material. The Prairie soils contain small amounts of iron and aluminum phosphate in the upper 20 to 25 inches of soil, while the Gray-Brown Podzolic soils contain large amounts of iron and aluminum phosphate at similar depths. The distribution of total phosphorus indicates a large net loss of phosphorus from both Prairie and Gray-Brown Podzolic soils. A curvilinear relation was found between soil pH and iron, aluminum, and calcium phosphates in the horizons of the two soil groups below about 20 inches.

Third. Quantitative determinations of the distribution of layer silicates in a Tama soil developed from Peorian loess show that the clay of the calcareous C horizons contains large amounts of montmorillonite and illite, and smaller amounts of vermiculite. The vermiculite content of the clay decreases with increasing proximity to the soil surface while the montmorillonite content of the clay remains relatively unchanged up to the A horizon. Pedogenic chlorite becomes appreciable in the A and B horizons while montmorillonite in the A horizon decreases, concurrent with an increase in the allophane content. The

montmorillonite in the C horizons of the soil has a high iron content while that at the soil surface is lower in iron and higher in aluminum. The kaolinite content of the clays is small and about equally distributed throughout the soil profile.

Microfilm \$2.00; Xerox \$6.80. 141 pages.

## NON-STEADY STATE WATER TABLES OF TILE DRAINAGE.

(L. C. Card No. Mic 59-3383)

Ben Leo Grover, Ph.D.

Iowa State College, 1959

Supervisor: Don Kirkham

A scaled drainage model was constructed and verified. The model was made of plexiglass and brass screen cylinders as drains, with glass beads as the porous medium and glycerol as the viscous fluid. Tests were made to determine the validity of the model by showing that the flow was laminar as in field drainage and that scaling had been accomplished on the dimensions of the model and size of capillary fringe.

A series of experimental runs was made in which the geometry of the system was varied through a wide range of values of tile spacing and depth for each of seven basic geometries. These basic geometries consisted of variations of the location of the tile with respect to the impermeable layer, in the case of a homogeneous porous medium, and of the location of the tile with respect to the surface of a sublayer in a system with two layers of different conductivity.

The data are presented in the form of photographs of the shape of the surface of saturation and in figure form using dimensionless functions of the values of discharge rates or times of fall so that the data can be easily used in drainage design. Numerical examples of such use are included for clarity.

Comparisons between the data obtained for rate of fall of the surface of saturation and data of Kirkham and Gaskell showed, for their special case, reasonable agreement. Calculated spacings using "Glover's" equation were lower than experimental values.

Microfilm \$2.00; Xerox \$6.80. 141 pages.

AN ANALYSIS OF THE DIFFERENCES IN ATTITUDES AND ACCOMPLISHMENTS OF DAIRY FARMERS IN URBAN AND RURAL TOWNS OF CONNECTICUT WITH IMPLICATIONS FOR EDUCATION.

(L. C. Card No. Mic 59-3195)

Wilbur Ray Hesseltine, Ph.D. University of Wisconsin, 1959

Supervisor: Professor Burton W. Kreitlow

A total of 412 questionnaires were sent to 206 "rural" and 206 "urban" dairy farmers in Connecticut to determine

what differences exist between these groups in their attitudes and accomplishments.

The rural dairy farmers were selected at random from the least densely populated quartile when all Connecticut towns were ranked according to density of population. The urban dairy farmers were similarly chosen from the most heavily populated quartile. The data gathered were based on the calendar year 1957 and were collected by a mail survey or direct contact during the first half of 1958.

In order to minimize bias, 28 of the 169 towns were eliminated. In the 71 towns from which the sample was drawn there were 862 dairy farmers in the 35 rural towns and 573 in the 36 urban towns. Twenty-one farmers in the rural towns and 22 farmers in the urban towns had either died or gone out of business from the date the list was compiled until contacted. An overall percentage return of 68.6 per cent was realized. A total of 253 questionnaires, 140 from the rural towns and 113 from the urban towns were completed in total or in part so as to be useful in the study. The mean days taken by the 140 rural farmers to respond was 26.8 days while the comparable figure for the 113 urban farmers was 35.0. The t test shows this difference to be significant at the 5 per cent level.

Of 62 questions asked, 8 or 12.9 per cent were found to be statistically significant at the 5 per cent level of probability. The statistical tests employed were chi square and t tests.

Urban dairymen operate significantly fewer total acres but production per farm is greater. Tillable acreages were about the same. Urban dairymen do not contemplate herd expansion to the degree that rural dairymen do and they are somewhat more pessimistic about the future of dairying in the Northeast.

Urban dairymen have not purchased bulk tanks to the extent that rural dairymen have. Urban and rural dairymen appear to do equally well as crops men, in accepting approved herd management practices and with the exception of bulk tanks, are equally concerned about substituting equipment for labor.

Both groups share favorable attitudes in regard to agriculture as an occupation. Rural and urban dairymen seem equally concerned about gaining subject matter data; each participates with equal frequency in nonagricultural organizations, and similarly accept responsibility in positions of agricultural leadership. Most all dairymen accept the trend toward urbanization philosophically.

The data imply that urban dairymen, particularly, need special consideration if they are to remain in business. Alternative methods of operating would seem like a logical suggestion for extension education.

Of all farmers reporting, 25 per cent indicated that dairying is getting less important as a means of livelihood.

Although the effects of urbanization on agriculture appear somewhat stimulating, these effects may be of short duration. The urban movement would seem likely to eventually take most of the agricultural land adjacent to the urban center. This investigation may serve as a benchmark in determining where agriculture succumbs to urbanization.

Microfilm \$2.00; Xerox \$6.20. 127 pages.

A STATUS STUDY OF PROGRAM DEVELOPMENT IN THE NEGRO DIVISIONS OF THE COOPERATIVE EXTENSION SERVICES OF TEN SOUTHERN STATES.

(L. C. Card No. Mic 59-3196)

William Bailey Hill, Ph.D. University of Wisconsin, 1959

Supervisor: Professor Gale L. VandeBerg

The purposes of this study were to determine: (1) the status of Extension work with Negroes relative to personnel and administrative organization; (2) the extent to which program planning practices used in the Negro Extension divisions were in keeping with accepted theories of program planning; and (3) needs of Negro county Extension agents for state staff help, training, and facilities.

Data were collected, through mailed questionnaires, from the state leader for Negro work and from the Negro county agents in one-third of the counties in each of ten

southern states.

Twelve generally accepted theories in county Extension program planning were developed from a review of literature. Program planning practices used in the Negro Extension divisions were considered in relation to eleven of those theories.

Seven hundred seventy-three Negro men and women were employed in 412 counties; and 66 Negro men and women in state staff positions in the Cooperative Extension Services of ten southern states in 1958. Negro Extension personnel per state ranged from 29 countyworkers and a state staff of 2; to 137 county workers and a state staff of 16. The Negro state staff-county staff ratio for the ten states was 1 to 11.7 compared to the national ratio of 1 to 3.5. Negro county Extension agents generally divided their time between adult and youth work.

Negro Extension divisions were generally separate units; with state staff headquarters in nine of the ten states in a different locality from that of the state director and other state staff. In five of the ten states, no member of the Negro state Extension staff devoted full time to administration. In three states, no Negro state staff member devoted full time to 4-H Club work.

Approximately one-fourth of the counties in five of the ten states had no long-time county Extension program

plan.

Most Negro and white program planning committees met separately to develop county Extension programs and annual plans of work. In only 6 percent of the counties did Negro and white lay people meet jointly to plan Extension programs.

Nearly all of the counties had agricultural, home economics, and youth groups represented on the county program planning committee. Only 19 percent of the counties had civic groups, and only 45 percent had urban and rural nonfarm interests represented on the committee.

There was relatively little involvement of state staff and other agency personnel in analyzing data, determining priorities of problems and interests, and in helping determine objectives and goals, in the counties.

In 60 percent of the counties, a statement providing for evaluation was included in the plan of work.

In relation to program planning procedures, state staffs had helped county Extension workers most in col-

lecting situation data, and least in getting professional people to serve on committees and analyzing situation data. Agents in all ten states felt a strong need for state staff help in training committee members for program planning.

Negro Extension agents thought their training needs were the greatest in (1) evaluation in Extension, (2) communications media and methods, and (3) agricultural eco-

nomics-including farm management.

Negro county agents and state leaders in seven states indicated that considerable improvement was needed in office facilities. State leaders and agents in five states felt a great need for more adequate office space and location, more clerical help, and more Negro county personnel.

State leaders for Negro work and agents in all ten states indicated a strong need for more opportunities for graduate training.

Microfilm \$2.65; Xerox \$9.20. 202 pages.

## COMMERCIAL COTTON FARM OPERATORS' PERCEPTION OF THE CALIFORNIA AGRICULTURAL EXTENSION SERVICE.

(L. C. Card No. Mic 59-3203)

Winferd Mathis Lawson, Ph.D. University of Wisconsin, 1959

Supervisor: Professor Glenn Fuguitt

The purpose of this study is to determine what kind of picture is carried in the minds of commercial cotton farm operators regarding the California Agricultural Extension Service. The study has two principal objectives: to describe the commercial cotton farm operators' perception of the California Extension Service; and to explore the relationships between the respondents' perception of Extension and the variables of Extension involvement, education, size of farm, age and tenure.

Information was gathered in the fall of 1958 from a stratified random sample of 349 farmers who grew more than 25 acres of cotton in 1958 in the eight cotton growing counties in California.

## Summary and Conclusions

## Commercial cotton farm operators' perception of Extension

- 1. A relatively small percentage of commercial cotton farmers fully understand the organization of the California Extension Service.
- 2. Commercial cotton farmers want Extension to continue to help them solve their immediate problems.
- 3. In addition to help with specific everyday problems, commercial cotton farmers want more help with problems which go beyond the farm gate.
- 4. Commercial cotton farmers are willing to "share" Extension's time with non farm families on a limited basis and think that providing educational assistance to commercial firms and farm organizations is an efficient use of Extension's time.

- 5. Mass media methods are considered more help than personal contacts to a greater number of cotton farmers in their farming operation.
- 6. Contact with a method is related to evaluation of that method, but frequent contact does not necessarily result in high evaluation of helpfulness.
- 7. Seemingly minor events may block communications channels from Extension to farmers.
- 8. Commercial cotton farm operators have a high regard for Extension personnel's qualifications.
- 9. Commercial cotton farm operators in general consider the California Extension Service a useful and essential source of agricultural information, which contributes materially to their success in farming.

## Relationship of respondents' perception to selected independent variables

- 1. Involvement is the primary factor of those tested affecting commercial cotton farmers' perception of Extension. Involvement is significantly related to understanding of Extension's purpose, evaluation of most helpful method, opinion of adequacy of staff, and appraisal of Extension's value.
- 2. Education is significantly related to respondents' perception of Extension in the case of understanding of Extension's purpose, evaluation of most helpful method, and appraisal of Extension's value.
- 3. Age is significantly related to respondents' perception of Extension in the case of evaluation of most helpful method and appraisal of Extension's value.
- 4. Size of enterprise is significantly related to perception in only one case; evaluation of most helpful method.
- 5. Tenure is not related to perception in any of the elements under consideration.

## **Implications**

- 1. Systematic Extension studies of farmers' thinking in each county would not only be well received, but would help build a more solid line of communication from Extension to the farmer.
- 2. Any statewide or county Extension program should provide for attention to the immediate, day to day problems facing the farmer.
- 3. Mass media methods are extremely valuable educational tools. Attention should be paid to making these methods as effective as possible.
- 4. It would be of value for Extension to study its clientele groups in various areas and to determine the characteristics of these groups as an aid in communicating effectively with them.
- 5. The over all picture of Extension in the minds of commercial cotton farmers is a very favorable one. However, Extension must constantly reappraise its efforts in the light of changing clientele needs to maintain this favorable picture.

  Microfilm \$2.85; Xerox \$9.80. 217 pages.

SPECIFIC SURFACE DETERMINATION OF LAYER SILICATES IN THE PRESENCE OF MICA.

(L. C. Card No. Mic 59-3207)

Om Prakash Mehra, Ph.D. University of Wisconsin, 1959

Supervisor: Professor Marion L. Jackson

The occurrence of interstratified mixtures of crystal layers of expanding layer silicates, montmorillonite and vermiculite, in weathered mica minerals in soils is frequently reported and this impairs a quantitative determination of these mineral components of soil clays.

In a gravimetric method improved in the present investigation, both montmorillonite and vermiculite are made to sorb a mono-interlayer of glycerol at 110°C by which the total and planar surface can be calculated. Total unit cell planar surface was computed as a sum of planar sorption surface and the mica unit cell interplanar surface (corresponding to potassium). This sum was found to be constant for a given unit cell formula weight, averaging 773  $m^2/g$ , with a standard deviation of  $\pm$  12.7. Colorado vermiculite had 1.63% K<sub>2</sub>O equivalent to 16.3% mica residue with a unit cell interplanar surface of 124 m<sup>2</sup>/g.; this added to the measured 631 m<sup>2</sup>/g. of planar sorption surface gives a total planar surface of 755 m<sup>2</sup>/g. Fithian illite (2-0.2 u) had 5.61% K₂O equivalent to 56.1% mica with unit cell interplanar surface of 426 m<sup>2</sup>/g. This added to 235 m<sup>2</sup>/g. of measured planar surface, gives a total of 661 m<sup>2</sup>/g. which when corrected to exclude 15% nonexpanding minerals (chlorite and kaolinite) gives a total planar specific surface of 775 m<sup>2</sup>/g. Wyoming montmorillonite had 803 m<sup>2</sup>/g. of planar specific surface. This principle of unit cell planar specific surface constancy of 2:1 layer silicates in weathered mica shows that the mechanism of K release from mica is by cleavage, and that the residual unweathered mica (or illite) has a full 10% K2O content by which it can be determined quantitatively.

In a new method for specific surface determination developed in the present investigation, montmorillonite is made to sorb exactly two interlayers of glycerol at 35°C in vacuum (less than 1 mm of Hg). In contrast, vermiculite sorbs only a mono-interlayer of glycerol both at 110°C and at 35°C in vacuum. The two specific surface methods combined give a guantitative analysis of montmorillonite and vermiculite even in complexly interstratified mixtures.

Wyoming montmorillonite sorbs 21.1% glycerol at 110°C and 41.6% at 35°C in vacuum, which gives an analysis of 98% montmorillonite. After the removal of amorphous material, fine clay fraction of Black Cotton soil (India) analyzed 94% montmorillonite and 5 to 10% kaolinite. Ladybrook (Australia) fine clay fraction sorbs 90% more glycerol at 35°C in vacuum than at 110°C, giving an analysis of 90% montmorillonite and 10% of monointerlayer expanding mineral.

The oxidation potential of the Na<sub>2</sub>S<sub>2</sub>O<sub>4</sub>-citrate system increases from 0.37 to 0.73 volts with increase in pH from 6 to 9, whereas the dissolution of iron oxides falls off (from 100% to less than 1%) with increase in pH from 6 to 12. Optimum conditions for maximum reaction kinetics and minimum iron-silicate destruction occur at pH 7.3. NaHCO<sub>3</sub> buffer was shown to hold the pH at optimum level, even though four moles of OH are used up in

reaction with each mole of Na<sub>2</sub>S<sub>2</sub>O<sub>4</sub> oxidized. Two milligrams of crystalline hematite dissolved in two minutes, while this amount of goethite dissolved completely only during three 15-minute treatments normally given for iron oxide removal from soils. Extraction of iron oxides from soils and clays high in free iron oxides and iron-silicates shows that bicarbonate buffered system was the most effective and selective method. Minimum destructiveness of this improved method was indicated by the least decrease in cation exchange capacity after the treatment of very susceptible Woody district nontronite, the decrease being 17% as contrasted to 35 to 80% with other methods. With soils, there was no decrease in exchange capacity with the improved method.

Microfilm \$2.00; Xerox \$5.00. 100 pages.

STUDIES IN THE CLEANING OF MILK HANDLING SURFACES.

(L. C. Card No. Mic 59-3281)

Joseph Jerome Peters, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor H. E. Calbert

One of the recent developments in the dairy industry has been the cleaning of pipelines in place. The success of an in-place cleaning procedure will be dependent upon many factors including the proper engineering and installation of the pipeline and other equipment, the temperature of the cleaning solution, an adequate velocity of the detergent solution, the length of time of the cleaning, and the proper selection of a detergent.

In order to study the feasibility of using certain techniques for evaluating cleaning and to show the application of such techniques in regard to the temperature of the cleaning solution, water hardness, and type of cleaning compound, both a gravimetric technique and a radioactive technique were employed.

Experimentation involving the gravimetric technique was performed by inserting stainless steel and pyrex plates into a laboratory device representing a milk pipeline cleaned by the circulation system. The plates were subjected to three different experimental treatments. Each treatment, consisting of a circulation of sanitizer, milk, and cleaning solution followed by a rinsing, was repeated fifteen times to complete one experiment.

The results indicated that the low temperature range for cleaning, 140°-85° F., was not as effective in cleaning as the high temperature, 160° F. However, with a combination of hard water (25 grains per gallon) and the low temperature range the use of a sequestering agent with a high concentration of chlorinated trisodium phosphate was effective in preventing a deposition from forming on the test plates.

Preliminary work was performed with the radioactive technique in order to find the most reliable means of applying it to cleaning studies. The relationship between weight removed and radioactive count removed was of primary concern. Of the three different methods available for radioactively labeling milk, in vivo labeled milk, P<sup>32</sup> added directly to the milk, and a radioactive culture added

to the milk, the latter procedure gave the best relationship between radioactivity removed and weight removed.

Thus, the technique was applied by suspending a radioactive culture of Escherichia coli in the milk sample to be studied. Films were prepared, dried until browned, and subjected to cleaning treatments. Conclusions were drawn in regards to removal of the bacterial cells for comparing one treatment with another without commenting on the removal of a definite weight of milk solids.

It was shown that there was a significant difference between cleaning at 160° F. and at 140°-85° F. while using the chlorinated trisodium phosphate and alkali cleaners. The 160° F. temperature effects a much greater removal of activity and bacterial cells. At the higher temperature chlorinated trisodium phosphate shows a greater removal of the soil than the alkali cleaner, while at the lower temperature range the reverse is true.

Microfilm \$2.00; Xeron \$5.40. 107 pages.

## CRITERIA FOR DETERMINING FINANCIAL SUPPORT OF COUNTY AGRICULTURAL EXTENSION WORK IN TEXAS.

(L. C. Card No. Mic 59-3215)

Daniel Charles Pfannstiel, Ph.D. University of Wisconsin, 1959

Supervisor: Professor Robert C. Clark

Funds are provided from three governmental levels – federal, state, and county – to finance agricultural extension work in the counties of Texas. Inconsistencies have developed in the apportionment of federal-state and county funds to meet the costs of the program. This study was undertaken for the purpose of providing the Texas Agricultural Extension Service with a formula, using appropriate criteria, that would ensure fair and consistent allocation of county extension costs to the county, the state, and the federal governments.

The procedure followed was to identify, from the literature and information obtained from district fiscal extension agents, criteria which might be used. Criteria were evaluated by a test that was formulated, consisting of a set of assumptions regarding desirable characteristics which the criteria and the formula should possess. Characteristics assumed to be most important were: (1) provisions for the employment of federal-state funds so as to establish a minimum extension program level for all Texas counties, based on need for the program; (2) relation of the amount of indicated county financial participation to an equalized support level from counties, based on ability to pay. Other characteristics sought in the formula were administrative efficiency, simplicity of operation, readily identifiable local responsibility, stability of indicated fund allocation, and ease of computing the formula.

On the basis of the test three groups of criteria were selected:

1. The first group of criteria, relating to the size of farm, rural non-farm, and urban population classes, was selected for determining the size of the extension program to ascertain the number of extension personnel

required in each county. The extension program, or work-load size, was measured in terms of farm family equivalents. This measure was based on the assumption that extension's first responsibility is to full-time farm people and that its responsibility diminishes as people are removed from full-time farming.

2. A second group of criteria, relating to county extension expenditures, was selected for determining the minimum county extension budget required to adequately support the staff size indicated for each county. The budget determination was based on minimum schedules of personnel salaries, travel allotments, and other necessary costs to a county in supporting its extension program.

3. The third group of criteria, relating to county assessed valuations, was selected for apportioning federalstate and county funds to each county extension budget. Apportionment was based on a scale indicating varying rates of financial participation according to county valuations. The indicated rates of county financial participation increased as valuations increased. A 5 per cent adjustment was established for size of staff. Counties having more than two agents were to have their indicated rates of participation decreased by 5 per cent for each additional agent over two. Counties having only one agent were to have their indicated rates of participation increased by 5 per cent. To ensure the use of both federalstate and county funds in each county, the maximum rate of county financial participation was fixed at 70 per cent and the minimum rate, at 20 per cent.

The use of these selected criteria in the recommended manner would enable state and county officials to make an exact determination of the amount of funds to be contributed from federal-state and from county sources. It was recommended that the formula established by this study serve as the basis for negotiating cost sharing agreements between the Texas Agricultural Extension Service and each cooperating county as represented by its commissioners' court.

Microfilm \$4.25; Xerox \$14.20. 329 pages.

THE COMPETITIVE POTENTIAL OF THE U.S. COTTON INDUSTRY.

(L. C. Card No. Mic 59-2217)

Vernon Wayne Pherson, Ph.D. Purdue University, 1959

Major Professor: Clifton B. Cox

United States cotton has been losing in the domestic as well as in the foreign market. In 1956, U. S. cotton production was almost the same while foreign production was about  $3\frac{1}{2}$  times as great as in 1920. During the same period, production of man-made fibers in the United States increased from 32,000 bale equivalents to nearly  $5\frac{1}{2}$  million bale equivalents.

The basic objective, therefore, of this study was to determine the future competitive position of the U.S. cotton industry in both the domestic and foreign markets.

In order to analyze the future position of the U.S. cotton industry, it was necessary to evaluate the influencing factors. Many factors were considered but five were

identified as the most important. They were real income, price, quality, promotion, and trade arrangements. The approach taken in analyzing the effect of these various factors was different from the usual statistical analysis of factors affecting the consumption of the commodity. In most studies, the assumptions are made, factors are quantified, equations developed and answers calculated and presented with some degree of probability or reliability. In this study, no attempt was made to reduce some of the factors to numerical quantities that could be inserted into equations. Emphasis was placed on those factors that can be affected by coordinated effort in the industry.

The analysis was limited to secondary data. Many previous research studies were reviewed and evaluated, and results of those studies, where applicable, were included in this analysis. Much of the information reviewed was unpublished. Some of it had been developed by personal interview from segments of the industry but never released. The author was allowed to evaluate the data, then summarize and use the results.

There is no one factor so important that it can cure all the ills of the industry. The U. S. cotton industry will share in the increased standard of living of the country only if it accepts the responsibility of seeing that certain things are done. These include:

1. Producing raw cotton that is competitive in quality with cotton of other countries and to a certain extent with man-made fibers. This is the result not only of cotton breeding and management practices but also the way the cotton is handled and the uniformity and descriptive material available about individual lots of cotton.

2. Pricing cotton so that it will be competitive in both domestic and foreign markets.

3. Producing cotton goods and goods containing cotton that have quality characteristics that are able to compete in the market. This will mean that considerable research must be done on end-use characteristics of cotton and an effort made to get these improvements used in production of products.

4. Continuing and expanding the promotion of cotton and cotton products and stimulating individual companies and organizations to compete for the consumer's dollar.

5. Securing legislation and governmental policy that will create a favorable environment for the growth of the industry.

It is believed that the cotton industry can survive in the future if it so desires without any preferential government treatment over that given to other similar industries. However, in the shortrun, subsidies or special legislation may be needed in order to make the transition from the present situation to a self-sufficient industry.

Microfilm \$2.95; Xerox \$10.20. 228 pages.

SOIL COMPACTION AND CORN GROWTH.

(L. C. Card No. Mic 59-3387)

Ronald Edward Phillips, Ph.D. Iowa State College, 1959

Supervisor: Don Kirkham

A field soil compaction experiment on Colo clay soil was conducted during 1956, 1957, and 1958 so that the effects of some soil physical properties as altered by soil compaction on corn growth and corn yields could be studied. Following the field soil compaction experiment, which indicated that mechanical impedance was limiting yields, a laboratory experiment was conducted so that the effects of mechanical impedance on corn seedling root growth could be studied.

In the field experiment, compaction was accomplished by running a farm tractor back and forth over the soil. The treatments in the field experiment consisted of three compaction levels and two fertility levels; each treatment was replicated eight times in a randomized block design. Irrigation water was available and the experiment was sprinkler-irrigated as needed during dry periods.

In the field experiment, corn plant growth, as measured by seedling emergence, plant heights, total yield of N, P, and K in leaves, tasseling and silking dates, quantity of roots in 2 cubic feet of soil, and corn grain yields, was significantly reduced as a result of compaction. Many of the plant measurements were reduced by as much as 50 percent. The interaction of compaction and fertility for the plant measurements was not statistically significant.

The large and significant differences in plant growth in the field experiment were found to be related to mechanical impedance as measured by fulk density and needle penetration (needle penetrometers have not been used previous in agronomic studies as far as the writer knows). Measurable differences in soil water, soil temperature at the 4-inch depth, and percent oxygen content of the soil atmosphere were not found between compaction or fertility treatments.

In one experiment in the laboratory, where the effect of mechanical impedance, as measured by bulk density and needle penetration, on the rate of root elongation of corn seedlings grown in Colo clay was studied, it was found that the rate of corn seedling root elongation decreased in a linear manner as bulk density increased from 0.94 g. per cc. to 1.30 g. per cc. or as needle penetration decreased. The corn seedlings were grown in the Colo clay samples at a moisture tension of 100 centimeters of water. Aeration porosity decreased from 26 percent to 9 percent as bulk density increased from 0.94 g. per cc. to 1.30 g. per cc. but it was shown that corn seedlings roots grew equally well in soil samples of widely different aeration porosities (7 and 26 percent) but of the same bulk density.

In a second laboratory experiment, corn seedlings were grown in differing diameter (6, 9, 17, and 22 millimeters) glass tubes filled with sand, Colo clay aggregates and Ida silt loam aggregates. The sand particles and the soil aggregates ranged in diameter from 250 to 500 microns. In the glass tubes filled with sand, the depth of root penetration into the sand was found to be proportional to the diameter of the tube which in turn was found to be proportional to the depth of penetration of a drill bit (a drill bit instead of a needle was used in this case) into the

sand in the tubes of differing diameter. The depth of penetration of the drill bit was considered a measure of mechanical impedance.

From the field and laboratory experiments it is concluded that mechanical impedance, as may be characterized by bulk density and needle penetrability, limits growth and elongation of corn roots and limits corn yields considerably more than has previously been recognized.

Microfilm \$2.00; Xerox \$6.40. 133 pages.

THE FUNCTIONS AND PROCEDURES OF SUBJECT-MATTER SPECIALISTS IN THE MISSOURI COOPERATIVE EXTENSION SERVICE.

(L. C. Card No. Mic 59-3286)

Carl Norman Scheneman, Ph.D. The University of Wisconsin, 1959

Supervisor: Associate Professor Gale L. VandeBerg

The general purpose of this study was to obtain information that could be used as a basis for strengthening specialist work in Missouri. Data were sought relating to requisites for hiring future specialists, the relative importance and performance of various specialist functions, the most effective, yet practical ways for specialists to provide help in the program areas and the changes Extension personnel desired in the amount and kinds of help.

Data were collected by individual and group interviews from all full-time personnel that had twelve or more months experience with the Missouri Cooperative Extension Service as of September, 1958. Ninety-six percent of the eligible respondents submitted useable data.

## Some of the Findings

- 1. Over four-fifths of Missouri Extension personnel felt that experience as a county worker and a Master's degree were essential requisites in the employment of future specialists.
- 2. The specialist functions of relatively high importance were those which provided help to agents: (1) in knowing and understanding technical information, (2) by supplying background and outlook information for program development, (3) by acting as a resource person for agents to phone or write on problems, (4) by maintaining two-way relationships with industries, (5) by preparing visual and other teaching aids to use in program execution.
- 3. The specialist functions of relatively low importance were those which dealt directly with local people in counties. These included such functions as: (1) training local leaders, (2) speaking to lay people at county meetings, (3) making individual farm or home visits, (4) participating in radio work.
- 4. Specialist functions identified as of high importance were not being performed as well as were several of the functions identified as of relatively low importance.
- 5. Approximately one-half of the county personnel suggested that more help by specialists needed to be given at the following stages of the county Extension program: (1) with the evaluation of methods and

accomplishments, (2) before the plan of work is developed, (3) during the development of the plan of work.

6. Specialists' suggestions and proposed projects for county programs were desired by county workers if provided prior to program planning committee meetings.

7. County workers, specialists, and the administrative staff stressed the need for specialists to give more emphasis to developing and maintaining effective up-to-date teaching aids, particularly written material and to deemphasize direct teaching of county clientel by specialists.

8. Specialists and administrators frequently expressed the need for closer coordination of work among specialists in related fields, as well as the need for strengthening relationships within departments between Extension specialists and their resident teaching and research counterparts.

Microfilm \$2.70; Xerox \$9.20. 205 pages.

THE DISTRICT EXTENSION LEADERS' AND THE BEGINNING COUNTY EXTENSION AGENTS' PERCEPTION OF THE BEGINNING AGENTS' ROLE DEFINITION AND ROLE FULFILLMENT.

(L. C. Card No. Mic 59-3287)

Edward Frederick Schlutt, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor James A. Duncan

The purpose of this study was to describe the district leaders' and the beginning county extension agents' perception of the beginning agents' role definition and role fulfillment. The data were obtained by personal interview with beginning county agents and their district leaders of the Wisconsin Cooperative Extension Service.

Role definition was determined from the district leaders' and beginning agents' perception of the degree of importance of thirty-eight select extension program functions. Role fulfillment was determined by the district leaders' and beginning agents' perception of the beginning agents' level of performance of the same extension program functions mentioned above. These functions were classified into six extension program areas.

#### Summary and Conclusions

a. The Beginning Agents' Perception of Their Role Definition and Role Fulfillment.

The beginning agents' perceived their role definition at higher levels than their role fulfillment. The "public and working relations" functions and "leadership development" functions were perceived highest in role definition and role fulfillment, and the "program development" functions, lowest in both role definition and role fulfillment by the beginning agents. Some agents consistently perceived their role definition and role fulfillment at higher levels while others consistently perceived these roles at lower levels.

b. The Beginning Agents' and the District Leaders' Perception of the Beginning Agents' Role Definition.

The district leaders perceived the beginning agents' role definition, higher than did the beginning agents. The "public and working relations" functions were indicated as most important by both groups; while the district leaders also perceived the "evaluation" functions "very important." The district leaders perceived the "program implementation" functions of least importance, while the beginning agents perceived the "program development" functions the least important in their role definition.

c. The District Leaders' and Beginning Agents' Perception of the Beginning Agents' Role Fulfillment.

The district leaders perceived the beginning agents' role fulfillment at higher levels than did the beginning agents. The district leaders and the beginning agents both perceived the beginning agents' role fulfillment, highest for the "public and working relations" functions. The district leaders perceived the beginning agents' role fulfillment lowest for the "evaluation" functions, while the beginning agents perceived their lowest role fulfillment in the "program development" functions.

d. The District Leaders' Perception of the Beginning Agents' Role Definition and Role Fulfillment.

The district leaders perceived the beginning agents' role definition at higher levels than the agents' role fulfillment. Beginning agents who perceived their role fulfillment and role definition at higher levels, also had a higher role fulfillment, as perceived by the district leaders.

#### **Implications**

The implications formulated from this study are directed toward extension personnel selection and training programs.

- 1. A systematic training program for all beginning agents.
- 2. More and early training of the beginning agents, in program development, implementation and evaluation.
- 3. Actual experiences in a training county prior to placement.
- Well qualified county personnel to work with beginning agents in the training county.
- 5. District leaders should agree on the procedures and policies of program development and implementation in their training program.
- 6. Definite standards of competencies expected of county extension agents, should be agreed upon by the district leaders.
- 7. More control and direction given county extension agents by district leaders.

## Selection

1. A personnel selection program that would eliminate those from employment, who lack the ability to develop the competencies required by county extension workers.

Microfilm \$3.80; Xerox \$12.80. 295 pages.

EFFECT OF VARIETY AND HARVEST DATE SYSTEMS ON ECONOMIC RETURNS FOR POTATO FARMS IN CENTRAL WISCONSIN.

(L. C. Card No. Mic 59-3222)

John Alfred Schoenemann, Ph.D. University of Wisconsin, 1959

Supervisor: Professor Marvin A. Schaars

This study concerns the problem of determining the best choice of varieties and their optimum harvest times which will result in the greatest economic return under various levels of prices for a range of typical-sized potato farms in central Wisconsin.

This study represents a relatively new approach to marketing research. This involves grower utilization of appropriate production and economic information in his decision-making through the farm management route. It is theorized that if production decisions are based upon market demands and consumer desires, as reflected by price, highest economic returns will thus result for the producer.

To obtain the necessary physical input-output data, comparative variety and harvest date studies were conducted over four consecutive seasons at an experiment station located in the problem area. Necessary input cost information was obtained through a survey of growers in the area. Price information was based upon actual prices prevailing over a nine-year period, 1950-1958. The technique and logic of linear programming were used in analyzing and evaluating the data.

The fundamental relationships investigated involve the production response of varieties at successive harvest dates and the change in prices as the season progresses. Three price pattern situations were developed for programming purposes: high, average, and low. The most profitable production choices were selected by determining the net returns to certain fixed factors for each programming process. The results were applied to five farm sizes ranging from 100 to 500 acres at each of the three price level situations. The limiting resources recognized in program selection are: farm size, harvesting efficiency, and grading and shipping capacity.

Specific gravity determinations were made of each variety at each of the different harvesting dates so as to ascertain the effect of time of harvest on this aspect of potato quality.

The Russet Burbank variety for late harvesting was determined the most profitable for producers under average or relatively low opening price situations. However, under the situation of relatively high opening prices early in the season, the use of early maturing varieties for early harvesting dominated the programs.

Small-sized farms were found somewhat more sensitive in terms of program changes resulting from shifts in price levels than were larger farms. It was also determined that producers in the area can effectively plan a production program in advance of the season, but must recognize the risk of uncertainty in not knowing the level of opening prices which will exist at the beginning of the harvest season. The possible use of certain advance price level indicators is considered.

From the grower survey results, the need is recognized for substantial improvements in certain cultural

practices such as planting rate, fertilization levels, and irrigation. The importance of improving harvesting, handling, and grading efficiency is also recognized in respect to their effects on optimum production programs.

Certain limitations of this study are apparent. There is need for further research involving the possible use of additional or newer varieties, the possibility of storage of part of the crop, and possible future improvements in technology affecting the input-output and cost-return relationships as determined in this study.

Microfilm \$2.75; Xerox \$9.60. 211 pages.

A STUDY OF THE PERSONAL AND SOCIAL BEHAVIOR OF SIXTH GRADE 4-H AND NON-4-H BOYS AND GIRLS IN TEN SELECTED WISCONSIN COMMUNITIES.

(L. C. Card No. Mic 59-3228)

Kalpa Nath Singh, Ph.D. University of Wisconsin, 1959

Supervisor: Professor Burton W. Kreitlow

Purposes of the Study

The purposes of this study were to determine the differences, if any, between sixth grade 4-H and non-4-H boys and 4-H and non-4-H girls in ten selected Wisconsin communities in their (1) personal and social behavior, (2) in the socio-economic status of their families, their social qualities, emotional stability and a series of interests, and (3) to describe the relationship between all possible pairs of variables.

Source of the Data and Design of the Study

This study was a part of the Longitudinal Study of Newly Formed Centralized School Districts in Wisconsin under the direction of Professor Burton W. Kreitlow. The investigation was limited to seventy 4-H and 225 non-4-H boys, seventy-eight 4-H and 174 non-4-H girls in ten selected Wisconsin rural communities. Tests and questionnaires administered to these boys and girls, their parents and teachers furnished materials for statistical analysis and tests of six null hypotheses.

Summary of the Findings

1. No significant differences were found in the sense of personal worth, feeling of belonging, social standards, and community relations between 4-H and non-4-H boys and 4-H and non-4-H girls.

2. A significant difference was found in the mean scores of social skills between 4-H and non-4-H boys in favor of 4-H boys, but not between 4-H and non-4-H girls.

3. No significant difference was found in the total mean scores on personal and social behavior between 4-H and non-4-H boys and girls.

4. Significant differences were found between 4-H and non-4-H boys in the socio-economic status of their families, in their social qualities and emotional stability in favor of 4-H members.

5. 4-H boys had a higher mean score in agricultural interests than non-4-H boys, the difference being significant at .05 level.

- 6. There were significant differences in the mean scores of art and reading interests between 4-H and non-4-H boys at .01 and .05 levels, respectively, in favor of non-4-H'ers.
- 7. No significant differences were found between 4-H and non-4-H boys in their interests on group activities, outdoor team sports, solitary activities, juvenile action and music.
- 8. The 4-H girls had higher mean scores on social qualities than non-4-H girls, the difference being significant at .05 level.
- 9. There was a significant difference between 4-H and non-4-H girls (.01 level) in the juvenile action interests in favor of non-4-H girls.
- 10. No significant differences were found between 4-H and non-4-H girls in the socio-economic status of their families, in their emotional stability, and interests in agriculture, group activities, music, art and reading.
- 11. Out of seventeen comparisons made, 4-H boys had higher mean scores on eleven variables than non-4-H boys, and 4-H girls had higher mean scores on thirteen variables than non-4-H girls.
- 12. The coefficients of correlation did not show relationships of consequence.

## **Conclusions and Recommendations**

The absence of significant differences in the majority of the selected components of personal and social behavior of 4-H and non-4-H members involved in this study and as tested by the modified form of the California Test of Personality could be interpreted to mean that the objective of the growth and development of a well-adjusted personality of the youth is not being achieved for this sample and at this age level. The results of the study could serve as a bench-mark for further investigations and if the findings are confirmed it would demand re-examination of 4-H Club objectives and its program contents.

The significant difference in the socio-economic status of the families of 4-H and non-4-H members in favor of 4-H members indicates the selective nature of the club work. This difference and other differences in social qualities, emotional stability and various interests of 4-H and non-4-H members, emphasize the need for flexibility and variety in the 4-H Club program.

Microfilm \$2.00; Xerox \$6.80. 142 pages.

## INDEXES OF THE INFLUENCE OF WEATHER ON AGRICULTURAL OUTPUT.

(L. C. Card No. Mic 59-2648)

James Larkin Stallings, Ph.D. Michigan State University, 1959

Major Professor: Glenn L. Johnson

In this thesis indexes of the influence of weather on yields of corn, oats, barley, wheat, soybeans, cotton, and tobacco are constructed. Indexes are also constructed for the influence of weather on some important aggregate measures of U. S. agricultural production and yields including the indexes of Crop Production, Gross Farm Production, Farm Output, Marketings and Home Consumption,

and Crop Yields per Harvested Acre. In addition, indexes were constructed for the feed grain components of the indexes of Crop Production, Farm Output, Marketings and Home Consumption, and Yields per Harvested Acre.

These indexes of the influence of weather were computed from time series of experimental plot data for the various crops located in the more concentrated areas of production. Series were obtained where as many variables as possible had been constant. The general procedure was as follows:

- 1. Trend was removed from each separate series for each crop at each location by fitting a linear regression line to the data. This was done to remove the influence of increases or decreases in soil fertility due to the particular treatment for each experimental plot.
- 2. Indexes for each series were computed as the ratio of the actual to the computed yields.
- 3. Indexes for each series for each crop at each location were averaged for overlapping years to get an index for each crop at each location.
- 4. Indexes for each crop at each location were weighted together into an index for the particular crop for the United States using average production for the area to be represented by the index at each location during the base period 1947-49.
- 5. Indexes for the seven crops were weighted together into indexes of the influence of weather on various aggregate measures of production and yields using value of production during the base period 1947-49. The Indexes of Range Conditions as presented in various U.S.D.A. publications were also combined into an index and used in two cases.

An evaluation of the sixteen indexes by various formal and informal techniques indicated that, in all but two cases, variations in the U. S. average yields of the seven crops and in the indexes of the various aggregate measures were highly associated with variations in the respective weather indexes. There was also an indication that an important amount of the variation in these crop yields and aggregate production and yield measures was due to the influence of weather. It was concluded that all but two of the indexes of the influence of weather are valuable measures to include in various econometric models where a weather variable is needed; and to use in a less formal manner to help explain and hypothesize about various relationships.

Microfilm \$2.15; Xerox \$7.60. 164 pages.

NITRATE PRODUCTION AND PLANT RESPONSE RESULTING FROM SOIL APPLICATIONS OF UREA, BIURET, TWO UREA-FORMALDEHYDE COMPOUNDS AND AMMONIUM SULFATE.

(L. C. Card No. Mic 59-3555)

Aubrey Wayne Tennille, Ph.D. The University of Florida, 1959

In a greenhouse pot study, ammonium sulfate, Uramite, and Borden's 38 were compared as fertilizer sources. It was found that the combined yields of oats and millet, when grown for 249 days, were approximately 13 to 20 per cent greater from soils fertilized with ammonium sulfate than from similar soils fertilized with either Uramite or Borden's 38. Fifty per cent more nitrogen was taken up from ammonium sulfate treated soils than from Uramite or Borden's 38 treated soils. Analysis of the soil for total nitrogen at the termination of the experiment revealed that from 15 to 60 per cent of the added nitrogen was not recovered in the plant material and soil.

Also in a greenhouse pot study, comparisons of urea, Uramite, and Borden's 38 as fertilizer sources were made. It was found that the total yields and nitrogen uptake were approximately the same for these three sources during a period of 143 days. From 3 to 55 per cent of the added nitrogen was unaccounted for in the plants and soil after the final harvest of millet.

Laboratory studies on the rates of nitrification of urea, biuret, and ammonium sulfate were made. These studies revealed that the nitrification rate of biuret was approximately 50 per cent lower than that from urea or ammonium sulfate during the first two weeks of incubation. After two weeks, the rate of nitrate production from biuret, urea, and ammonium sulfate was approximately the same. Additions of urea and lime to a previously limed mineral soil raised the pH value above the limiting reaction for nitrification and no nitrates were produced.

Plate counts of soils treated with biuret, urea, and ammonium sulfate revealed that no significant differences in numbers of organisms were found after one and two weeks of incubation.

Microfilm \$2.00; Xerox \$5.60. 114 pages.

## MEAT PACKING PLANT EFFLUENT AS AN IRRIGATION MEDIUM.

(L. C. Card No. Mic 59-3231)

Howard Albert Vollbrecht, Ph.D. University of Wisconsin, 1959

Supervisor: Professor L. E. Engelbert

Present day industrial and urban growth is presenting an ever increasing waste water disposal problem. Though wastes may be made bacteriologically safe, their nutrient content and high biochemical oxygen demand often seriously affect the biological balance of lakes and streams into which they are discharged. When waste waters are otherwise innocuous, their disposal by means of crop irrigation has proven economically feasible and even beneficial.

During an eight year period, the effect of treated meat packing plant waste on crops, soils, and percolate has been investigated through lysimeter studies employing three distinctly different soils, namely a silt loam, a sand, and a peat.

Appreciable quantities of nitrogen, phosphorus, and potassium and considerable amounts of sodium were added to lysimeter soils through effluent irrigation. Lysimeter losses of nitrogen, phosphorus, and potassium were primarily due to crop removal because only small amounts were detected in the percolate. While approximately onehalf of the effluent nitrogen added was removed by crops, the balance could not be accounted for in the percolate or soil. Conclusions were that the nitrogen not accounted for was lost through denitrification. Much of the effluent phosphorus and potassium not taken up by crops was fixed in the soil. Sodium in the effluent displaced large quantities of soil calcium and magnesium which were leached from the soil primarily as chlorides and bicarbonates. This resulted in a sodium saturation of 8 to 21 percent in the Miami silt loam. The high sodium content, and instability of the subsoil when leached with water, indicated an alkali soil condition, especially in the 12 to 24-inch horizon. Sodium accumulation did not affect soil pH appreciably. While the soluble salt content of both the water and effluent irrigated soils increased with depth, electrical conductivity values of saturation extracts from these differently treated soils were similar and did not indicate saline soil conditions.

In large lysimeter studies, optimum and high rates of effluent irrigation of the silt loam soil produced hay yields which were over 100 percent greater than the water irrigated and the no irrigation treatments. On the sand, optimum and heavy effluent irrigation treatments produced yields which were 113 and 141 percent greater, respectively, than the water irrigation treatment. Conclusions drawn from deficiency symptoms and lower hay yields indicated that water irrigation caused considerable leaching of nitrogen, but under effluent irrigation, the leaching effect was masked by effluent nitrogen.

Because many industrial waste waters are high in sodium and large amounts of sodium can have a very deleterious effect on the structure of fine textured soils, sodium saturation studies with Miami silt loam were conducted in the laboratory. The ameliorating effect of calcium and magnesium in the solution on soil absorption of sodium was also studied.

Soil leached with distilled water to which 1000 ppm. sodium had been added contained 325 percent more sodium than when leaching with water containing 57 ppm. calcium and 36 ppm. magnesium in addition to the sodium. In the former case the percent sodium saturation was about 30 percent, and structural deterioration occurred when the soil was leached with distilled water. There was no apparent structural deterioration following distilled water leaching of the soil previously leached with the solution containing calcium and magnesium in addition to sodium. These studies would indicate, however, that wastes containing 1000 ppm. or more of sodium would be unsuitable for long time irrigation of fine textured soils.

Microfilm \$2.00; Xerox \$6.20. 126 pages.

## FACTORS AFFECTING, AND METHODS FOR MEASURING LOW TEMPERATURE TOLERANCE OF ALFALFA, MEDICAGO SATIVA L.

(L. C. Card No. Mic 59-3397)

Donald Grant Woolley, Ph.D. Iowa State College, 1959

Supervisor: C. P. Wilsie

Winterkilling is one of the common causes of the loss of stands of alfalfa throughout the major alfalfa growing sections of North America. This study was undertaken to investigate the low temperature tolerance of several alfalfa varieties as influenced by selected factors of field management.

Low temperature tolerance was determined by electrical conductance and by crown recovery of root samples frozen at -8° C for 24 hours and thawed for 24 hours at 2° C.

In 1956, samples of three year old roots of four alfalfa varieties, Buffalo, A-224, Ladak and Vernal were subjected to hardiness analysis. Each of these varieties had been clipped to simulate grazing and also cut for hay during the 2 years previous to 1956. Phosphorus and potash were applied each year.

In 1957, one year old roots of two alfalfa varieties, Buffalo and Vernal were sampled. These varieties were seeded at row spacings of 6, 12, 24 and 42 inches, and fall clipping treatments were applied. In 1958, forage yields, stand counts, and hardiness measurements were taken.

Cold units were accumulated in each fall of the three years (1956-57-58). A cold unit is a one degree Fahrenheit deviation below a  $60^{\circ}$  F base in the daily mean soil temperature at a depth of 4 inches.

In the fall of 1957, a seeding of Ranger alfalfa involved the spacing of individual plants in areas of 3 1/2, 5, and 16 square inches under 2 mulch cover treatments of 2 tons of chopped straw per acre, an oat companion crop. Another study included broadcast seedings on three dates, August 17, September 2, and September 16 with the same mulch treatments as described above. Forage yields and stand counts were taken.

The results of the study are summarized as follows:

- 1. The influence of fertilization on hardiness was not statistically significant.
- 2. Differences in varietal hardiness were noted, with Vernal and Ladak the most hardy and Buffalo the least hardy.
- 3. Plants which had been clipped frequently demonstrated less hardiness than plants which had been harvested for hay.
- 4. The date of root sampling had a highly significant effect on hardiness in each of the three sampling years.
- 5. The time of fall clipping significantly influenced hardiness, mid-September clipping being the most harmful.
- 6. Though not consistently significant, plants tended to show an increase in hardiness as width of row was decreased. This was most noticeable when the alfalfa was fall-seeded.
- 7. The spacing of fall seeded alfalfa in two-dimensions had a marked effect on forage yield, but no significant influence on winter survival.
  - 8. The covering of fall-seeded alfalfa with a straw

mulch significantly reduced winter survival, but increased the forage yields over the check.

- 9. The date of fall seeding alfalfa had a significant effect on forage yields. The use of some type of mulch cover became an important factor in increasing forage yields as the seeding date was delayed.
- 10. Electrical conductance was not correlated with crown recovery at any one sampling, but the two methods were highly correlated over all sampling dates in each year.
- 11. Correlations between electrical conductance and cold unit accumulation, and between crown recovery and cold unit accumulation were highly significant.
- 12. A close association between cold unit accumulation and the rate of hardening of alfalfa was postulated.

  Microfilm \$2.00; Xerox \$5.20. 105 pages.

## AGRICULTURE, ANIMAL CULTURE

AVITAMINOSIS E AND NUTRITIONAL MUSCULAR DYSTROPHY IN RELATION TO INDUCED STRESSES.

(L. C. Card No. Mic 59-2992)

Robert Frederic Borgman, Ph.D. Kansas State University, 1959

A purified diet was used in weanling rabbits to obtain an apparently uncomplicated deficiency syndrome of avitaminosis E. The course of the deficiency was observed by histological examinations of muscle biopsies, by electrocardiograms, by urine creatine and creatinine determinations, and by histological examinations of the gonads, heart, adrenals, and pituitary. The oxygen uptake of heart and skeletal muscle slices was determined by a manometric technic.

After obtaining the picture of this apparently uncomplicated avitaminosis E in rabbits, various induced stresses were employed to determine their effect upon the deficiency. Various endocrine alterations were employed, such as injections of adrenal cortical extract, parathyroid extract, and methylandrostendiol. It was found that the adrenal cortical extract hastened the skeletal muscle degeneration of avitaminosis E, but not that in the myocardium. The parathyroid extract may have had a slight aggravating effect upon skeletal muscle degeneration, and the methylandrostendiol may have had a slight retarding effect. Rabbits which were thyroparathyroidectomized a week before placing them on a vitamin E deficient diet did not have lesions as severe as the negative controls.

Cod liver oil administered orally in a single daily dose caused degeneration in the skeletal muscle and myocardium to be severe in rabbits deficient in vitamin E. Omitting fat from the diet did not result in an alteration in the deficiency syndrome of avitaminosis E in rabbits.

When other vitamins were omitted from the diet of rabbits, concurrent with avitaminosis E, there was evidence that skeletal muscle degeneration was more severe in those rabbits not receiving biotin and vitamin B 12, niacin, riboflavin, pyrodoxine, and pantothenic acid. The evidence for the latter two was the most convincing.

A histochemical test for acetylcholinesterase activity at the myoneural junction did not reveal any decrease in the activity of this enzyme in severely dystrophic skeletal muscle from vitamin E deficient rabbits.

The electrocardiograms had abnormalities indicative of mild disturbances in heart function in vitamin E deficient rabbits, and could be qualitatively related to the extent of alteration found in the myocardium at sacrifice or death. The urinary creatine and creatinine determinations showed the creatine concentration increased with avitaminosis E, although the increase was not as great as generally reported by other workers. The adrenal sections generally had a hypertrophy of the zona glomerulosa with vitamin E deficiency.

In rabbits deficient in riboflavin, pantothenic acid, or pyrodoxine, either singly or concurrent with avitaminosis E, no change occurred in the per cent dry matter of the skeletal muscle or heart, or the oxygen uptake by heart slices after three weeks on the diet. The oxygen uptake of skeletal muscle slices was generally increased by these deficiencies, except that avitaminosis E alone did not result in an appreciable increase in oxygen uptake.

Two pairs of male fraternal twin calves were placed on the same diet the rabbits had received shortly after birth. However, the diet was mixed in warm water. One twin of each pair was maintained without vitamin E, and the other maintained as the positive control. The deficiency syndrome was relatively mild when compared to white muscle disease in calves described by the literature. The vitamin E deficient calves succumbed to an ingestion pneumonia, probably because of a defect developing in the swallowing mechanism caused by skeletal muscle degeneration in the tongue and glottis. No creatinuria or marked change in the urine concentrations of sodium, potassium, and calcium was associated with avitaminosis E. The blood concentrations of hemoglobin, erythrocytes, leucocytes, and glucose were not affected. The electrocardiograms indicated only mild changes in heart function until the terminal phase, when the changes became marked. Microfilm \$2.70; Xerox \$9.40. 206 pages.

SLAUGHTER AND CARCASS CHARACTERISTICS OF BRAHMAN, SHORTHORN, AND BRAHMAN-SHORTHORN CROSSBRED STEERS.

(L. C. Card No. Mic 59-3540)

James Woodford Carpenter, Ph.D. The University of Florida, 1959

Four lots, containing sixty-three weanling steers fed 140 days in dry lot, were studied over a four year period. A fifth lot containing four purebred Shorthorn steers was added to the study during the last year. Lot 1 contained 15 3/4 Shorthorn x 1/4 Brahman steers; Lot 2, 16 1/2 Shorthorn x 1/2 Brahman steers; lot 3, 16 1/4 Shorthorn x 3/4 Brahman steers; lot 4, 16 purebred Brahman steers and lot 5 had 4 purebred Shorthorn steers. All animals were selected according to weight, age, type, condition and feeder grade. Composition of rations, length of feeding trials, handling, hauling and slaughter conditions were kept as nearly constant as possible for the four year period.

At the termination of 140 day feeding trials, the animals were weighed and trucked 196 miles from the Range Cattle Station, Ona, Florida, to the University Meats Laboratory at Gainesville, Florida. Upon arrival, animals were weighed, fasted overnight with access to water, weighed and slaughtered the following day.

Average daily gain, total shrinkage, slaughter weights and percentages of items removed at slaughter such as head, hide, feet and gastrointestinal tract were recorded. Carcass grades, cooler shrinkage, dressing percentages, cut-out percentages of wholesale cuts, physical and chemical composition of the 9-10-11 rib cut, tenderness evaluation on steaks and roasts, hide thickness and cannon bone

breaking strengths were studied.

Cattle of predominant Brahman breeding had significantly lower carcass grades, higher percentages of feet and hide, a lower percentage of gastrointestinal tract and contents, a greater length of leg, thicker hides and thinner chucks, a higher percentage of fore shank, round, sirloin and the high priced cuts (round, rib and loin) and lower percentages of short plate, kidney knob and flank than cattle of one-half or more Shorthorn breeding. The 9-10-11 rib cut from carcasses of predominantly Brahman breeding had more lean, less fat, more bone, less ether extract and more moisture and protein than the 9-10-11 rib cut from carcasses of steers of one-half or more shorthorn breeding.

Tenderness of roasts was influenced by breeding. Microfilm \$2.00; Xerox \$6.80. 145 pages.

THE UTILIZATION BY THE CHICK OF D AND L ISOMERS OF AMINO ACIDS ON LIQUID AND SOLID DIETS.

(L. C. Card No. Mic 59-3074)

Ralph Vincent Fell, Ph.D. Louisiana State University, 1959

Supervisor: Dr. A. B. Watts

Studies were conducted to determine if a chemicallydefined water soluble diet could be adapted for use with chicks. Diets patterned after one reported to have been fed successfully to rats through several generations proved toxic to day-old chicks.

The effects on livability and weight gain of altering physical state, carbohydrate source, protein or protein equivalent, pH, sodium and potassium level, and age of

chicks were studied.

High mortality resulted from all liquid diets except those which contained a natural product of high molecular weight.

A disturbed water balance associated with tissue dehydration was a common symptom preceding death. The toxic effect appeared to result from the solution of amino acids.

In experiments using solid diets, the availability to the chick of the D, L and DL forms of nine essential amino acids was investigated. Growth trials and urine analysis studies were conducted.

The D and L forms of methionine and phenylalanine were found to be equally effective in supporting growth in the chick.

D lysine exerted a depressing effect on growth at all levels studied when fed in a racemic mixture.

D histidine apparently produced no effect on growth. Isoleucine, threonine, leucine and tryptophan were similar in that the D isomer produced little or no growth when fed alone but appeared to be utilized to a much greater extent when over one half the chicks requirement was met by the L form.

D valine supported some growth even when fed alone and was utilized to a greater extent when supplied in a racemic mixture. D valine at high levels exerted a definite toxic effect.

Microfilm \$2.00; Xerox \$3.00. 54 pages.

METHODS OF MEASUREMENT OF THYROID SECRETION RATE AND THE EFFECTS OF ALTERATION OF THYROID SECRETION RATE ON DAIRY CATTLE EXPOSED TO HOT AND COOL CONDITIONS.

(L. C. Card No. Mic 59-3075)

Foster Benton Hamblin, Ph.D. Louisiana State University, 1959

Supervisor: Professor James E. Johnston

Since there seems to be a lack of agreement among investigators as to accurate procedures for determining thyroid secretion rate a study was conducted to compare protein-bound iodine and I<sup>131</sup> extrapolation procedures. Thyroprotein feeding has been reported in many studies, however there is a lack of information on which to base recommendations for Louisiana conditions. A study using thyroprotein was inaugurated for this purpose.

Eight non-lactating cows were placed in a climatic control chamber in the fall of 1957, and again in the spring of 1958. Thyroidal activity was determined by serum protein-bound iodine and I<sup>151</sup> extrapolation techniques.

The amount of protein-bound iodine varied from 5.76 to 6.57  $\mu$  gm.% during the fall trial and from 5.00 to 6.30  $\mu$  gm.% during the spring trial. By the use of I<sup>31</sup> extrapolation technique thyroxine secretion rate was found to range from 0.077 to 0.195 mb./100 lbs. body weight and 0.070 to 0.205 mgm./100 lbs. body weight for the fall and spring trial, respectively. The two methods had a positive correlation during the fall (r = 0.59) and a negative correlation (r = -0.70) in the spring. Correlation between fall and spring values were 0.09 for protein-bound iodine, and 0.99 for total secretion rates and secretion rates per hundred weight. Loss of weight due to low levels of nutrition resulted in an apparently larger variation in secretion rate per hundred pounds than in total secretion rate.

Twenty lactating Jersey cows were allotted to four groups of five cows each. Two groups were put in a climatic control chamber under simulated sub-tropical conditions, and the other two groups were placed in an adjacent shade barn under normal fall conditions. One group at each location was given thyroprotein at the rate of 1.5 grams per hundred pounds body weight.

Milk production for the thyroprotein treated group in the cool barn was 8.02% more F.C.M. than their controls during the 40 day full feeding of thyroprotein. The thyroprotein treated cows in the hot chamber initially had a higher milk production than their controls, but by the end of the experiment were giving less than their controls. A 20-day withdrawal period was not effective for physiological readjustment since both thyroprotein treated groups gave over 20% less F.C.M. than their controls, postexperimentally.

Fat percentages were significantly greater in thyroprotein treated animals. Highly significant differences were obtained for solids-not-fat by both thyroprotein treatment and climatic conditions probably due to changes in energy intake.

Forage was changed from alyce clover hay and millet silage to alfalfa hay in the middle of the experiment. This resulted in an increased F.C.M. from all groups. Analysis of variance gave highly significant differences (P < 0.01) among groups for F.C.M., per cent fat and per cent solidsnot-fat.

Thyroprotein administration under cool conditions produced no deleterious effects. Thyroprotein feeding under hot conditions resulted in decreased milk production, severe weight losses, and thermal stress.

Microfilm \$2.00; Xerox \$5.80. 120 pages.

HERITABILITY AND REPEATABILITY OF FIRST, SECOND, THIRD AND FOURTH RECORDS OF VARYING DURATION IN BROWN SWISS CATTLE.

(L. C. Card No. Mic 59-3263)

Lawrence Arnold Johnson, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Ernest L. Corley

The reliability of the first lactation record as an indication of the breeding value of the cow for milk and butterfat yield is important to the dairy cattle breeder. In this study heritability estimates of first, second, third and fourth lactations, averages of two, three and four records and of 100 and 200-day partial first lactations were made to determine the reliability of using partial or complete first lactation records as the basis for early selection in Brown Swiss cattle. Repeatability was also computed so as to provide both heritability and repeatability estimates which are lacking for the Brown Swiss breed.

The data used consisted of 8,413 records of not less than 200, or more than 305, days in length from 38 Brown Swiss herds in Wisconsin. These herds had been on Herd Improvement Registry test for five or more consecutive years between 1936 and 1957. Original entry cards were obtained from the Brown Swiss Breeders' Association. The records were computed according to the regular DHIA procedure and standardized to a 2X, M.E. basis. The average production was 10,043 pounds of milk, 404 pounds of butterfat, and 4.02 per cent butterfat for the 8,413 records. Heritability estimates were obtained by doubling the intrasire regression of daughters on dams.

The heritability estimates for milk and butterfat ranged from .26 to .47 for the first lactation; -.10 to .38 for the second; -.09 to .33 for the third and .50 to .58 for the fourth. For percentage of butterfat the estimates were .53 to .80 for the first record; .69 to 2.35 for the

second; .70 to .75 for the third and .71 for the fourth lactation. Extreme variations and rather high standard errors were encountered in the three and four lactation groups where the number of daughter-dam pairs available was small. Regressing the daughters first lactation on the average of two, three and four records of the dams gave heritability estimates of .34 to .50 for milk and butterfat and .68 to .81 for percentage of butterfat. When the average of two, three and four records was used for both daughters and dams the estimates ranged from .25 to .40 for milk and butterfat and .68 to .87 for percentage of butterfat. For 100-day records heritability estimates were of the order of .30 for milk and butterfat and .44 for percentage of butterfat. For 200-day records they were .34 for milk and butterfat and .63 for percentage of butterfat. Except for a highly significant difference between 100 and 305-day percentage of butterfat the differences between the 100, 200 and 305-day regressions were not significant.

Heritability estimates for all first lactation records were 0.42 for milk, 0.37 for butterfat and 0.80 for percentage of butterfat. These values are at the upper limits of the results found in previous studies for other breeds.

Repeatability values were .47 for milk, .45 for butterfat and .68 for percentage of butterfat. These values are in close agreement with estimates reported by many workers on other breeds of dairy cattle.

Microfilm \$2.00; Xerox \$4.20. 78 pages.

ESTIMATION OF THE PERCENTAGE OF FAT AND LEAN IN THE EDIBLE PORTION OF STEER CARCASSES.

(L. C. Card No. Mic 59-3407)

Walter Herbert Kennick, Ph.D. Oregon State College, 1959

Major Professor: David C. England

A knowledge of the composition of beef carcasses is essential to the fulfillment of genetic and nutritional studies concerned with the increased production of desirable lean meat. Genetic improvement in yield of desirable lean meat will result from including in the selection index either live body composition or carcass composition of progeny. Likewise, a complete evaluation of nutritional studies must include the composition of the animals or carcasses produced by the various nutritional regimes being studied. To be of general use methods of determining composition must be relatively simple and inexpensive to carry out.

The literature indicates that the lean body mass of an animal tends to be much more constant than the total body mass. Therefore the major changes in percentage of body constituents must result from changes in the fatty tissues. Simple methods of estimating the composition of beef carcasses, such as specific gravity, area of fat in the cross section or the rib, thickness of cover over the longissimus dorsi and composition of probe samples are all attempts to measure the fat content of the carcass and depend on the validity of the hypothesis that the fat free animal is a practical constant for prediction of other constituents. The above relationships indicate the possibility of estab-

lishing reasonably accurate methods of estimating the composition of beef carcasses by techniques which can be carried out quickly and inexpensively with a minimum of laboratory equipment. The methods used in this experiment were chosen for investigation because they meet these criteria.

The measures studied as predictive values were: (1) weight of fat in several probe samples of 9-10-11th rib, (2) percentage of fat in several probe samples of 9-10-11th rib, (3) specific gravity of the 9-10-11th rib cut, (4) cross sectional area of the longissimus dorsi muscle at the 12th rib, (5) total lean area in the cross section of the rib at the 12th rib, (6) percentage of lean area in the cross section of the rib at the 12th rib, (7) total fat area in the cross section of the rib at the 12th rib, (8) percentage of fat area in the cross section of the rib at the 12th rib, and (9) warm carcass weight.

Numerous prediction equations were derived from these measures. The multiple regression prediction equation which used weight of fat in two side probes and warm carcass weight as independent variables predicted the percentage of protein in the edible portion of the 9-10-11th rib with a standard error of estimate of 0.71% of the protein content and a multiple correlation coefficient (R2) of 0.7349. The multiple regression prediction equation which used percentage of fat area in the rib cross section and warm carcass weight as independent variables predicted the percentage of fat in the edible portion of the 9-10-11th rib with a standard error of estimate of 2.16% of the fat content and a multiple correlation coefficient (R2) of 0.8830. The standard error of estimate of these prediction equations indicates sufficient accuracy to detect relatively small differences in percentage of protein and fat in the edible portion of the 9-10-11th rib and consequently in the carcass.

Microfilm \$2.00; Xerox \$4.20. 76 pages.

RELATIONSHIP OF LIVE LAMB MEASUREMENTS TO CARCASS CHARACTERISTICS AS AFFECTED BY DIFFERENT BREEDING SYSTEMS.

(L. C. Card No. Mic 59-2996)

Doyle Jensen Matthews, Ph.D. Kansas State University, 1959

Twelve breeding systems were studied to evaluate a probe technique for determining carcass muscling characteristics, to determine the affect of conformation differences upon carcass characteristics, and to evaluate wholesale cut percentages and gross tissue composition as indices of desirable attributes in lamb carcass.

Hampshire, Southdown, and Suffolk rams were mated with Rambouillet, Columbia, and Western Blackface ewes. Weaning weight, adjusted for the effects of year of birth, type of birth (single or twin), sex, and age, was selected as the measure of productivity. Weaning weights of 673 lambs produced in five lamb crops during the period extending from 1953 through 1957 were analyzed.

No significant differences were found in the adjusted weaning weights of lambs produced by the three types of ewes.

The effect of ram breed upon the weaning weight of

lambs was highly significant. The rank of the ram breeds for adjusted lamb weaning weights was Suffolk, Hampshire, Shropshire, and Southdown, respectively. Suffolk and Hampshire lambs were significantly heavier than Shropshire and Southdown lambs.

No differences were found between ewe type or ram breed for the cross-sectional area of the longissimus dorsi muscle or depth of fat over the twelfth rib after these characteristics were adjusted to 100 pounds live weight.

The live lamb probe technique involved measuring the depth of skin, fat, and the longissimus dorsi muscle with a needle one inch laterally from the midline of the vertebral column over the right transverse process of the second lumbar vertebra. Width of the longissimus dorsi muscle was made by halving the measured distance between the lateral extremities of the transverse processes of the second lumbar vertebra. The product of these two measurements was an estimate of cross-sectional area of the longissimus dorsi muscle. The technique was studied on 46 U.S. prime and choice grade lambs and another group of 40 U.S. choice and good grade lambs. The estimate of cross-sectional area of the longissimus dorsi muscle was highly significantly correlated with the actual area of the muscle in the carcass. The partial correlation coefficients, independent of live weight were (.55) and (.69) in the first and second trial, respectively. The estimate of depth of the longissimus dorsi muscle was more accurate in predicting actual depth and cross-sectional area of the muscle than the estimate of width in predicting width or area. The probe method of estimating the crosssectional area of the longissimus dorsi muscle was superior to any other live measurement for predicting the area of the muscle in the carcass.

Width, depth, compactness, and hind saddle development were visually appraised and scored. The scores were negatively associated with measurements of length and height in the lambs and were highly positively related to degree of fatness in the carcass. Visual appraisals of width, compactness, and hind saddle development were not highly related to wholesale cut yields in the carcass except in the role of being mutually related to fatness. Depth score was not highly related to carcass traits.

The wholesale cut percentages indicated that the wholesale cuts of lamb carcasses may be divided into two groups, those positively related to increased fatness: loin, rack, and breast; and those positively related to increased leanness: leg and shoulder. Fatness was negatively associated with the cross-sectional area of the longissimus dorsi muscle in the lambs; thus, the area of "eye" muscle was smaller in the fatter lambs compared to leaner lambs of the same live weight. The correlation coefficients between carcass traits and either grade or depth of fat at the twelfth rib were similar, thus indicating a close relationship between carcass grade and fatness. Carcass grade was negatively associated with all measurements of muscling and meatiness in the carcass. Marbling and the ether extract content of the longissimus dorsi muscle were significantly correlated with fatness; however, color of lean was essentially independent of carcass grade and fat depth.

Microfilm \$2.00; Xerox \$5.00. 99 pages.

SOME EFFECTS OF ENERGY SOURCE UPON PERFORMANCE OF GESTATING HEREFORD COWS.

(L. C. Card No. Mic 59-3158)

William Kenneth Roberts, Ph.D. State College of Washington, 1959

Thirty-six gestating Hereford cows were randomly allotted to six different groups of six animals each. Each cow received 10 pounds of roughage daily, which consisted of either alfalfa hay, wheat straw or various combinations of these two roughages. Concentrates were fed in graded levels in order to equate the calculated TDN and nitrogen intakes among groups. The number of days each animal received the experimental rations (including a 30-day lactation period) varied from 160 to 245.

Data collected pertaining to the performance of the cows and calves indicate the following:

- 1. That change in body weight of cows during the last half of gestation was largely dependent on the energy intake per unit of body weight. This was shown by a significant negative correlation (P < .01) between initial cow weight and change in weight during the following 120-day period.
- 2. Each of the 36 cows produced a calf. One was born dead, another was exceptionally weak at birth and the remaining 34 were normal. The weak calf was considered normal when two weeks of age.
- 3. That birth weight of the calves was not influenced by the weight of dam at parturition. The correlation (r=.148) between these two entities was not significant.
- 4. These was no significant difference among treatments in birth weight of calves.
- A significant negative correlation (P<.01) was found between increase in weight of the calf from birth until 30 days postpartum and decrease in weight of the dam during this same period.
- 6. That 6.8 pounds of TDN, as calculated from Morrison's feeding tables, will adequately maintain gestating cows (ranging in weight from 850 to 1296 pounds) during the last half of pregnancy. This suggests that the National Research Council's recommended level of 10 pounds of TDN per head daily is too high.

Digestion trials were carried out using the lignin ratio technique. Results of these trials showed the following:

- Dry matter digestion was significantly decreased (P<.01) as wheat straw replaced alfalfa hay in the ration.
- Crude fiber digestion was slightly increased as crude fiber level in the ration increased. This increase in crude fiber level was due to replacing alfalfa hay with wheat straw.
- 3. There was no significant difference among groups in protein digestion.
- NFE digestion was significantly affected (P<.01) by the various treatments. As alfalfa hay was increased in the ration, NFE digestion was also augmented.

- 5. Energy digestion presented a pattern similar to NFE digestion. These was a significant difference (P<.01) in energy digestion among treatments. It was highest in treatments where alfalfa hay was the only roughage, and lowest in treatments where the roughage consisted of only wheat straw.
- For every pound of wheat straw replaced by alfalfa hay there was a 1.29 percent increase in digestible energy.
- 7. Derived TDN values were considerably higher than TDN values calculated from Morrison's (1956) feeding tables.

Microbial activity was determined on rumen samples, collected from one animal receiving each ration and the following was observed: Microbial activity was highest in rumen ingesta collected from the animal receiving alfalfa hay as the only roughage and then progressively decreased as alfalfa hay was replaced by wheat straw. However, when the roughage consisted of only wheat straw there was an increase in activity. This may have been the result of a sampling error encountered when obtaining the rumen sample.

Microfilm \$2.00; Xerox \$3.00. 59 pages.

DEVELOPMENT OF A SWINE SELECTION INDEX INCLUDING LIVE ANIMAL MEASUREMENTS AS INDICATORS OF CARCASS QUALITY.

(L. C. Card No. Mic 59-3285)

Odis Wayne Robison, Ph.D. The University of Wisconsin, 1959

Supervisors: Professor A. B. Chapman and Assistant Professor H. L. Self

The study reported here was undertaken with the following objectives in mind:

- To investigate various live-hog body measurements at 154 days of age as to their value in predicting carcass merit at 210 pounds.
- To develop a selection index utilizing certain of these measurements combined with measures of productivity.
- 3. To develop and utilize a technique of constructing a selection index not requiring estimates of all of the phenotypic, genetic and environmental parameters used in the method of Hazel (1943).

The data in this study were gathered from pigs in the Wisconsin experimental swine breeding herd maintained in cooperation with the Regional Swine Breeding Laboratory. Live-animal measurements at 154 days of age and carcass information were obtained on a total of 663 animals during the period 1955-1957, inclusive. In 1957 live-animal measurements were taken at 84, 112 and 140 days on 167 animals.

The data in this study come from purebred and crossbred stock. All analyses were done within sex and breeding group. Therefore, it is believed that the regression equations presented are applicable to most herds maintained under the conditions specified.

These data indicate that when animals are fed ad libitum and killed between 187-220 lb. shrunk live weight, age and weight at slaughter have low, insignificant correlations with carcass traits.

These data indicate that measurements on live animals at relatively early ages may be used with some precision for predicting percent lean cuts. Backfat at loin and 154-day weight combined with width of loin, circumference of foreleg or length of foreleg provide an equation for predicting percent lean cuts with some degree of reliability. The relationships of these variables provide some insight into desirable meat type in pigs. Thick, long forelegs on a heavy pig with thin backfat is indicated as being desirable for meat type.

Estimates of heritability were obtained by doubling the intra-sire daughter-dam regressions. The estimates obtained were .20 and .40 for number in litter at 154 days and individual weight at 154 days, respectively. The genetic correlation between these traits calculated by the method of Lush (1948) was .24. The theoretical aspects of the biases of the estimates calculated by these methods when maternal environment is involved or when traits are measured in different years are presented.

The relative economic values of litter size and individual pig weight at 154 days of age and percent lean cuts, in terms of net income, were estimated as being 1:20:7.5.

The permanent improvement accomplished by selection is in proportion to the accuracy with which genetic differences among animals can be recognized. Since genotypes cannot be evaluated directly, selection must be practiced for some estimate of the genotype based on measurable characteristics. Consequently, the correlations between the genotypes and the variables used as a basis of selection provide logical bases for comparing the efficiency of different measures of genetic merit. The method of Hazel, as modified by Henderson, for constructing a selection index was compared to a prediction of progeny "value" from dam's phenotype. The correlations between index and aggregate genetic value for these two methods were 0.57 and 0.44, respectively. Reasons for expecting that these correlations might differ were presented even though they did not appear to be different.

The index proposed for practical use is not as accurate as others calculated but has the advantage of containing fewer variables. This index is:  $I_{\text{cl}_4} = -.4027X_3 - 4.3340X_5 + .0538X_6 - .2039X_8 + .1232X_9$  and is based on length of foreleg ( $X_3$ , in cm.), backfat at loin ( $X_5$ , in in.), individual weight ( $X_6$ ) and number in litter from which the individual came at 154 days ( $X_6$ ) and at farrowing ( $X_9$ ). The correlation between this index and the aggregate genetic value of the animals was 0.625.

Microfilm \$2.00; Xerox \$3.00. 55 pages.

EMBRYO MORTALITY AND FACTORS
AFFECTING CORPUS LUTEUM MAINTENANCE
IN PREGNANT SWINE.

(L. C. Card No. Mic 59-3289)

Harold Glen Spies, Ph.D. The University of Wisconsin, 1959

Supervisors: Professor L. E. Casida and Professor H. L. Self

This study was designed to examine the effect of exogenous progesterone and hysterectomy on the maintenance of the corpora lutea in pregnant gilts and to determine the importance of proper function of the corpora lutea for early embryo survival. A total of 212 gilts was used in four different experiments.

Progesterone given daily from the time of mating to 96 hours of gestation did not have a significant effect on fertilization rate (97.8% in the controls vs. 100% in the treated group) or upon visible embryonic development up to that time. Blastocysts from both the control and the treated group had 16-32 blastomeres present. Progesterone injected daily into intact gilts during various intervals between zero and 25 days of pregnancy produced no significant beneficial effects on embryo survival. Control groups slaughtered at day-18 and -25 of gestation had a higher embryo survival (72% and 83%, respectively) than two groups treated continuously from breeding to slaughter at the 18th and at the 25th day (1 and 0%), a group treated from breeding to the 18th day and killed on day-25 (0%), a group treated from breeding to day-4 and killed on day-25 (5%), and a group treated from day-4 to day-18 and killed on day-25 (22%). Treatment initiated at day-4 and continued until slaughter on the 18th day as well as treatments initiated on either day-4 or day-18 and continued until slaughter at the 25th day did not appear to have a deleterious effect on embryo survival (means of 96%, 72% and 79%, respectively). Progesterone injections started on the day of mating were detrimental to embryo survival in every case except the group slaughtered at 96 hours of gestation. It appears the exogenous progesterone had produced some harmful effects on the embryos or their environment by the fourth day, but these effects were not visible by 96 hours.

Progesterone and estrone were injected at the following dosage levels per lb. body weight daily; .3 mg progesterone plus .075 mcg. estrone, .6 mg. progesterone plus .15 mcg. estrone and 1.2 mg. progesterone plus .3 mcg. estrone. Injections were begun 72 hours after mating and ovariectomy was performed 96 hours after mating. Pregnancy was maintained to the 25th day of gestation in 8/9, 8/9 and 9/9 of the gilts in the three treated groups respectively as compared to 8/9 gilts in the control group. The percentages of embryo survival, calculated over all gilts per group, in the ovariectomized-hormone-treated groups were significantly lower than the percentage of embryo survival for the intact control group (means of 25%, 42% and 38% vs. 68%). The presence of dead embryos at autopsy in the ovariectomized-hormone-treated groups indicate some of the mortality was occurring late in the experimental period.

Gilts grown out on a high TDN ration have a significantly lower embryo survival at day-25 of gestation than gilts restricted to a moderate TDN intake for a comparable

period of time (67% vs. 90%). Progesterone injected daily from day-10 to -25 of gestation did not reduce the difference in embryo mortality between these two feeding groups.

Embryo and membrane weights of the hormone treated groups were not significantly different from comparable control groups in the intact-treated gilts, ovariectomizedtreated gilts or treated gilts on the different feeding levels.

Progesterone treatment decreased the average individual corpus luteum weight significantly in every group in the intact-treated gilts or treated gilts on the different feeding levels when compared to similar control groups. There was a significant association of percent luteal cells with vesicular nuclei and progesterone concentration of the corpora lutea between groups (0.76) and between individuals within groups (0.83).

Hysterectomy of gilts on the seventh day of the estrual cycle or of pregnancy maintained the life of the corpora lutea for a prolonged interval at least equal to the gestation period. Progesterone caused regression of the corpora lutea in hysterectomized gilts as well as in non-hysterectomized gilts indicating that the progesterone was not having its effect via the uterus. Local injections of 4 mg. of progesterone directly into the corpora lutea on the 18th day of pregnancy produced no effect on the weight of the corpora lutea by the 25th day. Transplants of estrual or luteal phase uterine tissue did not replace the role of the uterus in situ in its effect on the corpora lutea.

Microfilm \$2.00; Xerox \$4.20. 80 pages.

## NUTRITIONAL SIGNIFICANCE OF LINSEED MUCIN IN RUMINANT RATIONS.

(L. C. Card No. Mic 59-3390)

Charles Eugene Summers, Ph.D. Iowa State College, 1959

Supervisor: Dr. Wise Burroughs

Studies involving 132 lambs, 116 cattle, 168 guinea pigs, 32 rats and a series of in vitro experiments were conducted to determine the merits of linseed oil meal and fractions of linseed oil meal in ruminant rations.

The feeding of six pounds of flaxseed extract per lamb daily increased liveweight gains of lambs when fed in a ration containing nine per cent total protein. The feeding of 18 pounds of flaxseed extract per steer daily likewise resulted in an increase in liveweight gains of cattle. Gains were not stimulated in lambs when flaxseed extract was fed in a 12 per cent protein ration nor were they stimulated when only three pounds of flaxseed extract was fed daily in a nine per cent protein ration. These increased lamb and cattle gains could not be explained through additional nitrogen from the flaxseed extract. Results from a series of in vitro studies to aid in determining the factor(s) responsible for increasing lamb and cattle gains when receiving flaxseed extract indicated that the addition of either flaxseed extract or flaxseed extract dry matter had no stimulating effect upon in vitro cellulose digestion. Further results indicated that the addition of linseed oil meal mucin would stimulate in vitro cellulose digestion when added at levels from 16-60 milligrams. Later

observations indicated that the factor(s) responsible for this stimulation in in vitro cellulose digestion were apparently in the water-insoluble fraction of linseed oil meal mucin.

The feeding of 18 pounds of flaxseed extract per steer daily or the feeding of linseed oil meal at levels from 0.05 to 1.4 pounds per steer daily increased haircoat "bloom". Studies with laboratory animals indicated that the feeding of linseed oil meal mucin at levels of 0.9 and 1.8 per cent of the diet would increase the haircoat "bloom" of guinea pigs from 13-22 per cent. This increase in "bloom" was comparable to that observed by the feeding of linseed oil meal fed at levels to supply these same amounts of mucin (0.9 and 1.8 per cent). The feeding of a combination of sugars found in the water-insoluble fraction of linseed oil meal mucin and the ash of mucin increased the haircoat "bloom" of guinea pigs 85-90 per cent, giving results comparable to those observed when 1.8 per cent linseed oil meal mucin was fed in the same experiment.

The factor(s) in linseed oil meal responsible for an increase in haircoat "bloom" of animals appear at the present time to be present in the mucin fraction of linseed oil meal and more specifically in the combination of sugars found in the water-insoluble fraction of mucin and/or in the ash of mucin.

Microfilm \$2.15; Xerox \$7.60. 162 pages.

#### AGRICULTURE, FORESTRY & WILDLIFE

PHEASANT HUNTING AND MANAGEMENT ON WISCONSIN LICENSED SHOOTING PRESERVES.

(L. C. Card No. Mic 59-3243)

George Vanderkarr Burger, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Robert A. McCabe

Shooting preserves were established in Wisconsin with the passage of the Wisconsin Licensed Shooting Preserve Act in 1931. These preserves are privately owned areas, licensed by the state, on which some form of liberalized hunting of pen-reared game is permitted.

The objective of the research project reported here was to study the operations and management of Wisconsin shooting preserves in detail, and to evaluate the role of preserves in the over-all game management program of the state. A 2-phase approach was used: (1) intensive field research on pheasant stocking, hunting and habitat management on one preserve, and (2) an examination of past and present preserve activities on a state-wide basis.

The first or intensive phase of the study was conducted from June 1955 through June 1958 on the Bark River Game Preserve, Inc., near Sullivan, Jefferson County, Wisconsin. This 2,000-acre private preserve is the largest in the state in acreage and operational activities. The preserve lands consist primarily of low, flat marshland, dominated by brush, hardwoods, and herbaceous vegetation typical of southern-Wisconsin lowlands. Ten per cent of the area is under cultivation, primarily in wildlife food-patches.

Preserve shareholders and guests placed an average of 800 gun-hours of hunting pressure on the area annually, during the 90-day hunting seasons. Hunting success was excellent, due primarily to the release of about 1,700 pen-reared pheasants annually during the hunting season. Released birds comprised over 90 per cent of the harvest, and 50 per cent of the pheasants liberated were recovered. Introduction of changes in the timing, size, location and methods of stocking increased recovery and improved hunting success.

A crowing-cock and harem census revealed that only 10-12 per cent of the unshot released pheasants survived on the preserve each spring. Natural mortality on the preserve in winter appeared to account for most of the missing birds. Predation, "release shock" and crippling losses were the primary causes of mortality and appeared to operate most intensively on newly released birds.

A habitat-management study was aimed at (a) improving hunting and recovery of released birds and (b) increasing the survival of released birds and the size of the wild-bird population. Management experiments dealt with the design and composition of food patches, and the manipulation and planting of cover.

Inspections of 42 shooting preserves and interviews with the licensees, plus compilation of data on stocking and harvests on all preserves since 1932, supplied information for the second or extensive phase of this study.

The number of Wisconsin Licensed Shooting Preserves has remained relatively constant (60-72) each year since 1935. Restrictive provisions added to the original preserve law, resulting from initial opposition to the preserve concept by a portion of the public, apparently have limited growth. Over 90 per cent of all preserves licensed have been private and noncommercial.

From 1931 through 1956, shooting-preserve operators liberated a total of 171,362 pheasants, primarily during the hunting season, and harvested birds equivalent to 52 per cent of these releases. Shooting-preserve stocking probably makes no significant contribution to outside hunting at present, but preserves contribute importantly to the preservation and improvement of wildlife habitat, especially on wetlands.

Microfilm \$3.70; Xerox \$12.60. 287 pages.

RELATION OF HUNTING, WEATHER AND PARASITIC DISEASE TO WISCONSIN RUFFED GROUSE POPULATIONS.

(L. C. Card No. Mic 59-3248)

Robert Starbird Dorney, Ph.D. The University of Wisconsin, 1959

Supervisors: Professors J. J. Hickey and A. C. Todd

Population density of ruffed grouse was followed in northern Wisconsin from 1949 to 1958. The high period was generally 1949 to 1952, a low was reached in 1954 and an increase observed again in 1957. Average sex and age ratios taken in 10 hunting seasons showed a 50:50 juvenile sex ratio, a 54:46 adult male to adult female sex ratio and a population consisting of 80 per cent juveniles. Fall age ratios from road-shot birds were badly biased in

favor of juveniles. Spring age ratios from mirror-trapped cocks appear to be biased in favor of 2-year-old cocks since about one-third of the 1-year-olds failed to set up territories.

Hunting harvest tended to be density related in two study areas with the rate of exploitation varying from 7 to 34 per cent. Parasitic disease was density related since late-winter population levels were found to be directly related to infection of Ascaridia bonasae in young grouse the following summer. Parasitic nematodes and cestodes were commonly encountered, the incidence dependent upon the age of the bird and the time of year.

A warm May was characterized by above-average production and an almost even fall adult sex ratio; a cold May, by low production and a loss in adult females; high populations were more sensitive to May temperatures than low populations.

Fluctuations in numbers did not appear to have been caused by hunting losses. The decline noted was caused by increased winter and summer brood mortality. Once the population reached a low ebb, high reproductive gain and decreased overwinter losses tended to cause a recovery. Parasitic disease and May temperatures appear to play a role in these population responses noted.

Hunting, by artificially reducing density, should serve a useful purpose by removing or decreasing some of these density-dependent factors affecting production and survival. A spring hunting season on drumming cocks may be justified because of the low harvest of this segment of the population during the fall season.

Microfilm \$2.00; Xerox \$5.60. 114 pages.

#### ESTABLISHMENT OF FOREST TREE SEEDLINGS.

(L. C. Card No. Mic 59-3382)

Gordon Elwood Gatherum, Ph.D. Iowa State College, 1959

Supervisors: A. L. McComb and W. E. Loomis

More than 18 percent (472 thousand acres) of the commercial forest area in Iowa is in nonstocked stands containing a high density of undesirable shrubs and noncommercial tree species. Conversion of the brushy forest stands to those of good quality can be accomplished only by a more thorough understanding of forest tree seedling establishment.

The present study was designed to aid in the analysis of seedling establishment problems common to stand conversion practices in the State. The primary objectives were to (1) determine the minimum treatment needed to insure successful survival and growth, (2) study the relationships of light and soil moisture in plant competition, and (3) evaluate five species of conifers, European larch, Scotch pine, eastern white pine, Norway spruce and red pine, for adaptability to region, site and underplanting.

Field studies were made at the Brayton Forest in northeastern Iowa, and consisted of (1) practical understudy treatments to increase survival of five underplanted conifers, and (2) a more complete evaluation of overstory and understory competition with such plantings. Studies at the State Forest Nursery near Ames were planned to

determine the growth and photosynthetic characteristics of three of the underplanted conifers, European larch, eastern white pine and Norway spruce, and two shrubby hardwood species, dogwood and hazel, which offer serious understory competition in the forest.

The results of this stand conversion study led to the following conclusions: (1) an intensive cutting of the understory and overstory canopies is needed for maximum survival and growth of underplanted forest tree seedlings on the more fertile Iowa soils; (2) a gradual two-year release of understory-overstory canopies and/or the use of herbicides during the critical May-July growth period will probably be necessary to prevent extreme competition from a released shrubby and herbaceous cover; (3) light saturation values, based on photosynthesis and growth studies, ranged from 2,500 to 3,500 foot candles for all species except European larch; (4) drought survival of forest tree seedlings was increased with an increase in light intensity up to 3,000 foot candles; (5) European larch and eastern white pine are the only species recommended for underplanting at this time, the former because of its rapid rate of growth under intensive release cuttings, the latter because of its adaptability to shade and root competition under less intensive cuttings; (6) growth and photosynthetic rates of hazel and dogwood are sufficiently high to cause serious competition for all the coniferous seedlings studies; (7) the photosynthetic compensation point can be used as an indicator of the tolerance and efficiency of some species; and (8) tolerance is a result of the adaptability of a species to competition for light, soil moisture and nutrients; it may be used as an indicator of plant efficiency in terms of survival, but not generally in terms of maximum growth.

Microfilm \$3.35; Xerox \$11.40. 260 pages.

## A STUDY OF WATERFOWL ECOLOGY ON SMALL IMPOUNDMENTS IN SOUTHEASTERN ALBERTA.

(L. C. Card No. Mic 59-3199)

Lloyd Burrows Keith, Ph.D. University of Wisconsin, 1959

Supervisor: Robert A. McCabe

The object of this paper is to present information on waterfowl ecology and populations, derived from studies conducted over five breeding seasons on a group of small impoundments in southeastern Alberta. Though generally arid, the climate is characterized by extreme seasonal and yearly variations in rainfall and temperature. Ducks Unlimited (Can.) has been able to utilize surplus irrigation water to develop groups of permanent water areas on grazing lands in this region. Terrestrial vegetation on the study area consisted largely of mixed-prairie, Juncus, and halophytic communities. Potamogeton spp., Myriophyllum exalbescens, Ceratophyllum demersum and Chara sp. were the commonest submergents. Grazing effectively prevented the development of cattail shorelines. Stomachs from 209 adult ducks and ducklings, collected between May and October, revealed that Eleocharis palustris, Myriophyllum exalbescens, Potamogeton spp. and Carex spp. were the chief natural foods. Lesser

scaups, bluewinged teal and pintails were the most abundant breeding ducks. Pairs tended to move into pothole areas at the onset of nesting, and post-breeding drakes later concentrated on impoundments having extensive mudflats. Spring waterfowl populations responded inconsistently or not at all to changes in shoreline type (rushgrass to mud, and vice versa) stemming from manipulated water levels. Mid-August floodings of mudflats produced in spring and summer by slowly declining water levels attracted large numbers of adults and flying juveniles - a response evidently prompted by creation of a readily available food supply. The cattail-bordered potholes within a fenced area supported fewest breeding pairs per unit of shoreline. Partial removal of such cattail with herbicides resulted in a marked increase in pothole usage by both adult ducks and broods. A total of 1,078 nests were found during the study. In the early-nesting pintail, 90 percent of the hatch was spread over about 65 days; in the late-nesting scaup, 90 percent of the hatch was confined to about 25 days. Grazing did not seriously reduce nesting cover because unpalatable plant species were common. Nest densities averaged 2.6 ac. per nest. No consistent relationship was found between relative earliness of nest initiation and temperature and rainfall data; a heatsum taken each year during April 10-28 gave a highly significant correlation coefficient but this is viewed with some reserve. The striped skunk was the chief nest predator, accounting for at least 70 percent of predation on active nests. Hatching success ranged from 76 percent on mammal-free islands, to 35 percent on unfenced mainland areas and 22 percent in the fenced pothole area. The very low hatching success in the latter was due to a combination of high skunk populations and high nest densities, caused by the dense cover which developed after fencing. Over-all renesting rates calculated from data on numbers of pairs, numbers of nests and hatching success were: mallard - 163 percent, gadwall - 82 percent, shoveler -75 percent, blue-winged teal - 55 percent, scaup - 39 percent. Duckling mortality between hatching and flying averaged 24 percent, two-thirds occurring within the first week. Broods tended to move from potholes 1 ac. or less to larger potholes and lakes. Brood usage of lakes decreased approximately 25 percent when rush-grass shorelines were replaced by mud shorelines. Production on the study area averaged 3.7 flying juveniles per acre of water. If initial construction costs of this Ducks Unlimited project are written off over a 30-year period, and if maintenance costs and productivity remain about the same as in the past, the total cost per duck raised would average \$0.56, and the total cost per duck bagged would average \$2.07. Thereafter, the cost per duck raised and the cost per duck bagged would average \$0.08 and \$0.30 respectively. Generally speaking, waterfowl productivity rates in recent studies conducted on the prairie breeding grounds have equalled or exceeded mortality rates computed from band returns. Management of the study area and similar projects is discussed in terms of measures to increase breeding populations, nesting success, and duckling survival.

Microfilm \$3.40; Xerox \$11.60. 264 pages.

AGRICULTURE, PLANT CULTURE

YIELD AND OVULE DEVELOPMENT OF ALASKA PEAS AS INFLUENCED BY NUTRITION AND SOIL MOISTURE.

(L. C. Card No. Mic 59-3167)

James Fredrick Bartz, Ph.D. University of Wisconsin, 1959

Supervisor: Professor K. C. Berger

The problem of obtaining consistent, high yields of shelled peas is one of great practical importance to the vegetable industry. The greatest potential for increasing yields is to increase the number of peas produced by each plant.

An investigation was conducted on the influence of phosphorus nutrition on the fruiting of Alaska peas in both greenhouse and field experiments. The former were designed to study the rate of phosphorus uptake and its accumulation in the developing ovules. Results obtained showed that, at canning maturity, approximately two-thirds of the phosphorus in the peas was derived from the substrate and one-third from redistribution from other organs of the plant.

On the supposition that the rate of phosphorus uptake from the substrate may be limiting for pea development, supplemental phosphorus was applied to the foliage of plants at the blossom growth stage. Though yield results were inconclusive, the data showed that under conditions of a low phosphorus supply, foliar applications increased the phosphorus content of the peas. In general, the foliar applications had a greater influence on the number of pods per plant than on the number of peas per pod.

Two phosphorus fertilizer materials were combined with topsoil from three different profiles and two moisture levels in a greenhouse factorial study of phosphorus availability for Alaska peas. The effect on plant growth of varying soil moisture within an available range was much greater than the effects of either soil type or phosphorus treatment. In general, monopotassium phosphate resulted in both a greater growth response and tissue concentration of phosphorus than did monocalcium phosphate for all soil and moisture level treatments. There was no consistent relationship between the number of peas per plant and the phosphorus fertilizer compound used.

Field plot experiments included a trial in which fertilizer phosphorus and foliar phosphorus were employed singly and in combination using Alaska peas. Use of phosphorus fertilizer increased the yield of peas more than 600 pounds per acre. This increase was due, in part, to an increase in the number of pods per plant. Foliar applications of phosphorus did not increase the yield of peas where phosphorus fertilizer was applied. Phosphorus foliar spray without fertilizer resulted in a yield increase of 200 pounds per acre.

Two field trials were conducted in which the effect of several monobasic orthophosphate compounds on phosphorus uptake and yield of Alaska peas was studied. Results from both experiments showed a large tissue phosphorus response from all phosphate compounds for early vegetative growth. Ammonium phosphate tended to be superior to calcium, sodium or potassium phosphates for supplying plant phosphorus during early growth stages.

Plant counts of peas and pods revealed that practically all of the yield difference due to the phosphorus fertilizers was localized in the third pod node.

The influence of soil moisture levels on pod fill of Alaska peas was studied in a plant growing room. Results showed that low moisture levels from the blossom growth stage to maturity, decreased pod fill more than did low moisture levels from emergence to maturity. Moisture levels in excess of field capacity from blossom to maturity reduced pod fill more than any other treatment. The phosphorus content of the vines decreased while the phosphorus content of the peas increased with decreasing soil moisture. Decreasing soil moisture levels resulted in an increase in the potassium content of the vines.

The influence of phosphorus, calcium, boron and sulfur levels on fruiting of Alaska peas was examined with use of nutrient cultures. Results were expressed in terms of the vine weight-to-pea weight ratio. It was shown that this ratio ranged from less than one for the lowest level of phosphorus employed to infinity for the lowest levels of calcium and boron (no reproductive growth). The vine weight-to-pea weight ratio was apparently independent of the sulfur levels employed. This ratio varied from 2.2 to 3.6 for highest yields of both peas and vines under growth conditions for these experiments.

Microfilm \$2.00; Xerox \$6.00. 124 pages.

# HOST-PARASITE RELATIONS OF THE FUNGUS DOTHIDELLA ULEI P. HENN. ON THE HEVEA RUBBER TREE.

(L. C. Card No. Mic 59-3535)

Carlos H. Blazquez, Ph.D. The University of Florida, 1959

Related factors involved in the infection and growth of the fungus <u>Dothidella ulei</u> P. Henn were studied on various leaf stages of the Hevea rubber tree.

A black exudate was produced on diseased susceptible and resistant Stage 1 leaves.

Microscopic observations made on cleared leaf and paraffin embedded sections showed distinct differences between resistant and susceptible reactions to fungus infection. On resistant leaves appressoria were abundantly produced by germinating conidia, while only a few were observed on susceptible leaves. Generally direct penetration was observed on susceptible leaves.

A yellow material which gave negative results with various microchemical tests was detected soon after penetration of resistant leaf tissue and in the lesions of susceptible tissue.

Sclerenchyma-type cells found in lesions of old resistant leaves gave a positive tannin, and methyl pentose

No sporulation, stromatic mycelium, or fungus fructification were detected in any of the cleared leaf or paraffin embedded sections of highly resistant leaves.

Chromatographical determinations showed small amounts of d- and i-inositol present in the quebrachitol previously used in culture media. Cultural studies using chemically pure quebrachitol showed no significant difference between the contaminated and the pure quebrachitol.

There were no significant differences between 8 sugars and 1 sugar alcohol as sources of carbon tested in basal semi-synthetic media. Best growth was obtained in media using the combination i-inositol and 1 glutamic acid.

Media prepared from water extracts of H. brasiliensis clones gave good growth of the fungus. No growth was obtained in media from 6-month-old leaf water extract, or from 6-month-old leaves of F 4542, an H. benthamiana clone. No growth was obtained in media prepared from alcohol extracts, the only exception was the diseased 36-day-old susceptible leaf extract.

A yellow spot (compound 1) was detected in undeveloped chromatograms of healthy and diseased, resistant and susceptible leaf extracts. Under ultra-violet light and with ammonia fumes 3 blue fluorescent spots (compounds 2, 3, and 4) were detected. Compound 1 changed to a brown absorbent color when illuminated with ultra-violet light.

Compound 1 was found in all extracts from young leaves, while compounds 2, 3, and 4 were found only in extracts from young susceptible leaves and were not detected in extracts from young resistant leaves.

A spot (compound 5) which turned brown when treated with the silver-acetone developer was found in extracts prepared from healthy leaves, but not in those from diseased leaves.

Microfilm \$2.00; Xerox \$5.40. 107 pages.

# VARIANCE AND COVARIANCE FACTORS IN IMPROVEMENT OF SEED WEIGHT IN BROMEGRASS, BROMUS INERMIS LEYSS.

(L. C. Card No. Mic 59-3374)

Bertram Rodney Christie, Ph.D. Iowa State College, 1959

Supervisor: Robert R. Kalton

Two large groups of bromegrass clones were used to initiate an extensive study relating to seed weight and its possible improvement. Primary objectives were estimation of variability in seed weight, its relative heritability and its interrelationships with other agronomic traits.

Polycross seed of one group of 71 clones ranged in mean weight from 0.71 to 1.30 grams per 300 seeds. Topcross seed from the second group of 203 clones ranged in mean weight from 0.60 to 1.26 grams. Differences were statistically significant in both groups. Among the 71 polycrossed clones, the correlation between seed weight and open-pollinated fertility was 0.25. Among the topcrossed clones, seed weight was positively associated with seed yield, hay vigor and leaf width but showed little or no association with leafiness, leaf disease or bloom date. Association between seed weight and fertility were variable in this group. Mean seed weights of the 71 polycross progenies were significantly correlated with clonal means (r = 0.56), but the progeny-parent regression of 0.09 was non-significant.

Inbred progenies of 10 clones selected from the Polycross Nursery were evaluated for seed weight, fertility, seed yield and bloom date in replicated spaced plantings overseeded with alfalfa. Seed weight, fertility and seed

yield all exhibited substantial inbreeding depression, while inbreeding resulted in an average delay of one to two days in bloom date. Significant differences in performance were found among segregates in each family for seed weight, fertility and seed yield, indicating genetic segregation. Mean seed weights of the 230 segregates ranged from 0.52 to 1.30 grams per 300 seeds, but few superior segregates were found. It was concluded that inbreeding would be of little value for obtaining superior genotypes for any trait studied.

Correlations among seed weight, fertility and seed yield in inbred progenies were all positive with pooled correlations significant. The partial correlation between fertility and seed yield, 0.50, was higher than that between seed weight and seed yield, 0.22. Pooled correlations between bloom date and the other three traits were all negative and significant. Progeny-parent regression and correlation values for the four traits were significant. The regression value for seed weight, 0.39, was equal to that for seed yield but lower than that for fertility, 1.19, or bloom date, 0.78. Correlations ranged from 0.83 to 0.94.

From the Topcross Nursery, 10 of the highest and 10 of the lowest clones for seed weight were selected and each group recombined in isolation. Mean seed weights for approximately 1,000 progeny plants ranged from 0.44 to 1.62 grams per 300 seeds. Frequency distributions for the two progeny groups were distinctly different. Percent genotypic variance within both progeny groups was over 90%, indicating that opportunity for further progress by recurrent selection still exists.

Polycross and topcross progenies of the original clones also were evaluated for stand establishments and seedling forage yields. Both traits were positively associated with seed weight. Differences in seedling vigor attributes were significant but few progenies were superior to the check variety, Fischer.

Microfilm \$2.00; Xerox \$5.80. 120 pages.

TO TILLETIA CARIES (D.C.) TUL. AND

T. FOETIDA (WALLR.) LIRO.

(L. C. Card No. Mic 59-3149)

Joseph Clement Craddock, Jr., Ph.D. State College of Washington, 1959

This investigation dealt with the inheritance of the reaction of spring wheat factors for smut resistance as they were affected by fall seedings. The smut resistant, hard red spring wheat, Redman (C.I. 12638), was crossed with one susceptible and two smut resistant varieties of winter wheat. The winter wheat varieties Orfed and Elmar carry different factors for smut resistance, and Elgin is considered to be susceptible to all known races of smut. The hybrid progenies from these crosses were inoculated with individual races of smut selected on the basis of different parental reactions, as follows: (1) Redman resistant but not the winter wheat, (2) the winter wheat resistant but not Redman, (3) both parents resistant, and (4) both parents susceptible. A total of six different races of smut were used, but not more than three in any one cross.

Frequency distributions of progeny reactions indicated

the presence of three factors for resistance in Redman, with some factors reacting differently to different races. The observed  $F_1$  and  $F_3$  reactions of crosses inoculated with races L-4 and T-1 indicated that Redman possesses a recessive type of resistance to race L-4 but a dominant type of resistance to T-1.

The Redman resistance to race L-4 is explainable by one recessive and two dominant complementary factors for resistance, with one dominant factor in the susceptible variety Elgin being epistatic to each of the two dominant factors in Redman. Resistance to the races of <u>T. caries</u> was conditioned by one dominant factor for race <u>T-1</u>, and two incompletely dominant factors for race <u>T-6</u>. Redman's susceptible reaction to races <u>T-13</u>, <u>T-15</u>, and <u>T-16</u> was conditioned by recessive factors.

Although the identity of the factors for resistance was not determined, the observed segregations indicated that none of the so-called major factors (Martin, Turkey, Rio) for smut resistance were present in Redman.

Since some of the F<sub>3</sub> progeny rows were found to exceed the smut reaction of the parents, transgressive inheritance was indicated. Such transgressive inheritance can be useful in further increasing the smut resistance of winter wheat.

The results of these studies show that in evaluating and/or cataloguing the various smut resistant factors obtainable from spring wheats, one cannot depend entirely on the reactions to a single race of smut. For example, the results from this study indicate the possibility that an apparent recessive reaction to one race may become an entirely different reaction to another, which may or may not increase the resistance to smut in winter wheat.

Microfilm \$2.00; Xerox \$4.00. 75 pages.

EFFECTS OF VARIOUS CULTURAL PRACTICES ON ALFALFA SEED PRODUCTION.

(L. C. Card No. Mic 59-3150)

Philip Eugene Dade, Ph.D. State College of Washington, 1959

During 1956, 1957, and 1958 studies were conducted on the effects of various cultural practices on seed yield and other characters related to potential alfalfa seed production at the Irrigation Experiment Station, Prosser, Washington. The cultural practices studies were: (1) level of irrigation; (2) plant population; (3) date of first cutting; and (4) cutting schedule. In each of the first three phases seed yield, length of stem, number of racemes, number of flowers per stem, and number of pods per stem were determined. In the stand density studies the number of stems per plant were also counted. Seed yield and stems per plant were obtained for the cutting schedule plots.

The "medium" level of irrigation, in which soil moisture was maintained between field capacity and three-fourths depletion of the available soil moisture, was considered to be more desirable than other treatments. This treatment produced stems of slightly longer length and more racemes and flowers than other treatments. Theoretically, irrigating to maintain this range of soil moisture would conserve more moisture and require less labor than irrigation on other schedules.

The stand density of 14,520 plants per acre or a spacing of 18 inches between the rows and 24 inches within the rows produced significantly more racemes per stem and flowers per stem than other spacings which represented 65,014; 30,676; and 7,260 plants per acre. Seed yields were not significantly different in either year. The calculated number of flowers per acre was sufficient at the 65,014; 30,676; and 14,520 plants per acre level to set 1,600 pounds of seed per acre at tripping rates previously reported for the Yakima Valley. Planting alfalfa intended for seed production in rows did not result in higher yields but did indicate advantages in controlling insects and weeds.

Three dates of cutting of the first crop were compared to the first crop left for seed. Date of cutting was not significantly different from first crop seed in seed yield or other characters related to seed yield. Date of cutting should be related to the period of maximum activity of pollinators. The practice of leaving the first crop for seed resulted in an infestation of annual weeds, lodging, and poor quality seed.

Cutting alfalfa at the 8-inch stage for 2 years before harvesting the third year did not reduce seed yields significantly below that of plots cut at the hay stage for the same length of time. The effects of such cutting schedules on root reserves are apparently less severe than those of similar schedules under conditions of the Midwest. These conclusions are substantiated by previous experiments of frequency of cutting of alfalfa for hay in the Yakima Valley.

The combination of the best practices determined by these studies with various stand densities and partial and complete pollination is suggested for future study.

Microfilm \$2.00; Xerox \$3.60. 61 pages.

RESPONSE OF LIMA BEANS TO GROWTH REGULATORS.

(L. C. Card No. Mic 59-3012)

Richard R. Dedolph, Ph.D. University of Maryland, 1959

Supervisor: Dr. Francis C. Stark, Jr.

The influence of certain growth regulations upon yields and concentration of set in lima beans (Phaseolus lunatus Linn.) was studied in one greenhouse test and one field test. Concomitant to the investigations, an exponential sprayer was developed and methods for statistically reducing the data were revised.

The relationship of yield to growth regulator concentration, additives and loci of application were considered in the greenhouse experiment (var. Henderson). Glucose, boric acid, or borated-glucose were beneficial to yield when applied with Duraset (N-metatolyl phthalamic acid) in combination with various levels of IAA (Indole-3-acetic acid). The responses indicate that IAA at median concentrations increased initial set and at high concentrations decreased set to the level of the control. The application of IAA to the flower pedicels decreased set as compared to application of this compound to the tip or base of racemes, indicating the auxin gradient is not of primary importance in pod abscission. The curvilinear response of

pod set to IAA concentrations indicates a response to auxin level.

To facilitate the study of auxin levels, an exponential (variable dosage) sprayer was constructed. Formulae and methods and principles of construction are discussed. Because the machine applies decreasing concentrations in a systematic pattern, certain statistical difficulties are discussed and a suggested method of data reduction is presented.

A field study utilizing the exponential sprayer indicated that yield was directly correlated with the concentration of IAA applied at incipient bloom. The application of TIBA (2,3,5-triiodobenzoic acid) at concentrations of 1 to 1000 ppm resulted in a reversal of the IAA effect and showed no synergistic action at any concentration used. This indicates that yield is dependent upon auxin level and that in the pre-anthesis period the auxin level is critically low in lima beans. Repeated application of IAA or TIBA produced a cumulative effect but the most pronounced effect was from the pre-anthesis treatment. The increase in number of seed due to IAA treatment was greater than the increase in number of pods, indicating pod abscission and seed development to be separate and distinct systems. Another compound, Benzathiozolyl-2-oxyacetic acid, showed a great increase in number of pods at concentrations between 1 and 50 ppm, indicating that this compound has promise in promoting pod set. Increases in dry weight of seed due to IAA treatment approached 300%. The concentration response curves are also presented for 2,4,5-T (2,4,5-Trichlorophen-oxyacetic acid) and Duraset. Microfilm \$2.40; Xerox \$8.40. 184 pages.

# THE EFFECT OF CERTAIN GROWTH REGULATORS ON THE FRUIT SET OF CRANBERRIES (VACCINIUM MACROCARPON).

(L. C. Card No. Mic 59-3151)

Charles Carter Doughty, Ph.D. State College of Washington, 1959

A study was conducted to determine the ability of certain growth regulating chemicals to supplement natural pollination and increase the set of fruit on cranberries. Fourteen chemicals reported to have growth regulator ability were tested as whole plant aqueous sprays on both caged and uncaged plots of cranberry vines.

None of the growth regulators tested proved satisfactory for increasing the yield during the season when the treatments were applied. However, when p-chlorophenoxyacetic acid was applied at 20 p.p.m. at 45 to 55 per cent and again at 80 to 95 per cent full bloom, some increase in the number of blossom buds which were initiated was noted. A significant increase in yield occurred in the year following treatment. When the treatment was repeated in a year favorable for a good natural set of blossoms, no response was obtained in either the blossom bud set or in yield the following year.

Naphthaleneacetic acid, 2,4,5-trichlorophenoxypropionic acid, and naphthoxyacetic acid, when applied alone and in various combinations, induced initial increases in the percentage fruit set. The yields were not increased except in the case of naphthaleneacetic-naphthoxyacetic

acids where slight increases in yield and the number of seeds per berry were obtained.

The type of response to the treatments varied from one season to the next. This indicates not all phases of fruit development — yield, percentage fruit set and seeds per berry — respond to the same degree in the same season or in different seasons.

Responses to two or three chemicals applied as mixtures varied with the chemicals involved. Both additive and inhibitive effects of one chemical or another were obtained.

Histological study revealed that all concentrations of 2,4,5-trichlorophenoxyacetic at more than 5 p.p.m. were phytotoxic. All growth regulator treatments except 2,4,5-trichlorophenoxypropionic+naphthoxyacetic acids and naphthaleneacetic+naphthoxyacetic acids retarded the development of pollen grains and ovules in preanthesis buds. In some cases the treatment increased the amount of premature pollen grain germination in the preanthesis buds.

Combinations of 2,4,5-trichlorophenoxypropionic+ naphthoxyacetic acids and naphthaleneacetic+naphthoxyacetic acids tended to increase the rate of development of the embryo sacs in the preanthesis buds. The embryo sacs were larger and more fully developed than those from the untreated buds. Both chemical combinations also induced significantly higher percentages of fruit set.

Future studies might well be directed toward attempts to stimulate the initiation of a greater number of blossom buds, with a parallel study directed toward more adequate fertilizer programs to increase the carrying capacity of the cranberry vines.

Microfilm \$2.00; Xerox \$4.40. 85 pages.

PATHOLOGICAL HISTOLOGY, HOSTS AND CULTURE OF THE POTATO ROT NEMATODE.

(L. C. Card No. Mic 59-3186)

Lindsey Ralph Faulkner, Ph.D. University of Wisconsin, 1959

Supervisor: Professor H. M. Darling

This study deals with (1) techniques for propagation of Ditylenchus destructor Thorne, in the laboratory, (2) the role of fungi in the tuber rot incited by this nematode, (3) pathological histology of the disease and (4) the susceptibility of several economic plants to infection by the potato rot nematode.

To produce pure colonies of this nematode, 190 single gravid females were removed from naturally infected potato tubers. The females were washed in 3 baths of sterile distilled water and placed, one each, in petri dishes containing acidified potato dextrose agar and a fungus host. From these isolations, 16 colonies of D. destructor developed. Eleven of the colonies were reintroduced to potato and produced typical infections. Upon re-isolation, these nemas showed no apparent variation from the parent colonies or from nemas removed from naturally infected tubers. No colonies developed from 121 single egg isolations.

The nematode reproduced in large numbers on a culture of Torula sp. and on cultures of potato, clover, carrot,

and tobacco callus tissues growing in vitro. Culture reared nemas showed no apparent decrease in pathogenicity or change in morphology even after 4 years of continuous culture.

Cultures of 115 species of fungi, the majority of which were common soil forms, were inoculated with uncontaminated nemas from one of the pure colonies. D. destructor was found to feed and reproduce on 64 species of fungi, representing 40 genera, 8 orders and all major classes. These results indicated that the nematode has a wide range of fungus hosts and that fungi would therefore play an important role in its survival in nature.

Potted potato plants were inoculated with nemas from one of the culture reared colonies of the potato rot nematode, both alone and in combination with fungus hosts. Symptom expression was most severe when pots were inoculated with fungi in addition to the nematode.

Free-hand sections were made from naturally infected tuber tissues, representing various stages of disease development. Similar tissues were also processed by the paraffin method. Serial sections were cut at 20 u thickness, mounted on glass slides and stained with Conant's quadruple stain. Examination of the free-hand and serial sections indicated that, although the nematode can cause considerable damage to potato tissues in absence of other organisms, the presence of secondary invaders, primarily fungi, is necessary for the advanced stages of disease development.

Fifteen economic plants, other than potato, were inoculated with nemas from a culture reared colony of D.
destructor. Clover, alfalfa, parsnip, radish, sweet potato
and bulbous iris were found susceptible to attack by this
nematode. Of these, alfalfa, parsnip and radish have not
been previously reported.

Microfilm \$2.00; Xerox \$3.80. 66 pages.

THE UTILIZATION OF NITROGEN BY PEAS.

(L. C. Card No. Mic 59-1910)

William Lemuel Hollis, Ph.D. University of Maryland, 1958

Supervisor: Dr. Francis C. Stark, Jr.

Tests were conducted during 4 seasons, 1954-57, at the University of Maryland, to study the growth, yield, and N utilization of peas (Pisum sativum L.) as influenced by N applied in the form of mixed fertilizer, Cyanamid, and ammonium nitrate. N from mixed fertilizer and Cyanamid were applied in a factorially arranged study in 1954. Yields decreased as N from mixed fertilizer increased and vegetative growth increased. 300 and 360 lbs./A. N from Cyanamid showed foliar burning after blossoming due to root injury. Soil NO, and NH, levels were higher in plots receiving higher levels of N. Cyanamid, plowed down 4 days after application, gave no plant response in 1954 and 1955. Cyanamid, disked in, in 1956, increased plant N content and yields, and decreased tenderometer values. Cyanamid, disked in, in 1957, increased yields over equivalent amounts of N from mixed goods.

Studies of root distribution and related soil N levels showed N plowed down was concentrated on the plow sole.

This N was not attainable to the crop until roots grew into that area. Root growth in the surface 6" was increased 30 - 35% by disking in Cyanamid compared to the plowdown application. Yield, growth, and N utilization as influenced by N applied in mixed fertilizer, Cyanamid, and ammonium nitrate was compared. Each carrier, as a single source of N, increased yields over no N. N reclaimed in the crop from each carrier was: 87% from Cyanamid broadcast more than four weeks before plowing, 53% from mixed fertilizer drilled in, and 47% from ammonium nitrate top dressed prior to blossoming. Growth and yield were directly related to the total amounts of N present throughout the season in the root zone. Yields were particularly related to the N attainable during blossoming and 3-5 days before harvest. With limited N attainable just before harvest, growth was maintained by an accelerated redistribution of N from other plant parts, resulting in increased maturation. At processing maturity the pods and peas accounted for 40 - 50% of the total dry weight and contained 2/3 of the total N taken up.

Microfilm \$2.00; Xerox \$4.00. 74 pages.

COMBINING ABILITY OF UNSELECTED INBRED LINES OF CORN FROM INCOMPLETE DIALLEL AND TOP-CROSS TESTS.

(L. C. Card No. Mic 59-3386)

Stanley Dean Jensen, Ph.D. Iowa State College, 1959

Supervisor: L. H. Penny

Estimates of general and specific combining ability variances in corn populations are considered to be indications of the relative importance of additive and non-additive gene action. All possible (diallel) crosses among a group of inbred lines have been used in the past to obtain such estimates, but the method is limited by the number of crosses that can be tested. A relatively small sample of lines from a population can be studies in comparison to the possible genotypes of that population. In this thesis an incomplete diallel series was used. The method calls for only a portion of the possible crosses among a group of lines; therefore, a larger number of lines can be sampled.

The 29 lines used in this thesis study were developed without selection during the inbreeding process from the open-pollinated variety Krug. They were considered to be a representative sample of the genotypic make-up of that

variety.

Each line was crossed with eight of the remaining lines of the set in such a manner that there were 116 total single crosses. Also each line was crossed with four widely

used, high yielding lines.

Yield tests were conducted in 1957 at two locations—one in Iowa and one in Nebraska. Analyses of the results showed general combining ability variances to be greater than those for specific combining ability in the Iowa test, but the reverse was true in the Nebraska test. Both general and specific combining ability were significant at the 1 percent level at each location. In the combined analysis the general combining ability variance was non-

significant while the specific combining ability mean square was greater than in the individual locations analyses.

The top-cross test showed general combining ability to be greater than specific at each location and in the combined analysis.

Due to the inconsistent results it would be difficult to make accurate estimates of the relative magnitudes of additive and non-additive gene action in this population. Effects of stand difficulties on these estimates is discussed.

Correlation coefficients between estimated general combining ability values based on the incomplete diallel series and on the top-cross tests were significant at the 1 percent level in the Iowa test and non-significant in the Nebraska and combined analyses.

Predicted single cross yields based on top-cross performance were quite accurate in the Iowa test and quite inaccurate in the Nebraska test.

Microfilm \$2.00; Xerox \$4.00. 71 pages.

RADIATION RESPONSE OF BARLEY SEEDS IN RELATION TO HYDRATION AND TO CHEMICAL SUBSTANCES LOST BY LEACHING.

(L. C. Card No. Mic 59-3154)

Om Perkash Kamra, Ph.D. State College of Washington, 1959

Influence of soaking and germination on the radiation response of barley (Nordeum vulgare; hulless, variety (Himalaya) seeds (caryopses) was investigated. After soaking treatments the seeds were dried back and rehydrated to 16 per cent moisture. Thus, the seeds studied were essentially resting at the time of irradiation, yet modified by soaking. The criteria used for determining the X-ray response of seeds were: (1) injury expressed as seedling height of M<sub>1</sub> seeds measured after seven days' growth; (2) chromosome aberrations in shoot-tip cells of M<sub>1</sub> seeds; (3) seedling mutations in M<sub>2</sub> seedling populations; and (4) the kind and amount of substances lost in the water in which the seeds were soaked (leachates).

X-ray damage to barley seeds, in terms of seedling injury, chromosome aberrations and seedling mutations, increased when seeds had been soaked for more than 8 to 10 hours. Seeds soaked for 20 hours were most radio sensitive. However, there was some recovery of resistance when soaking was extended beyond 20 hours. Even 2 to 3 hours of soaking increased both the X-ray susceptibility of mitotic chromosome and the number of mutations recovered, whereas no increase in seedling injury was observed. Soaking alone, however, significantly increased the number of seedling mutations; it did not affect the seedling height appreciably. On the other hand, soaking produced stickiness of chromosomes.

Soaking appeared to cause increased sensitivity in seeds which persisted at the time of irradiation. Thus, amount of water at the time of X-radiation was not important, since the seeds were at a constant moisture level at the time of irradiation. It is suggested that the change in sensitivity may be related to the nature and amount of substance lost by leaching.

Chemical analyses of the leachates revealed the loss

of many substances from the seeds. Leached substances included several nitrogenous compounds (ninhydrin positive) - among them many amino acids ( $\alpha$ -alanine,  $\gamma$ -amino butyric acid, arginine, asparagine, aspartic acid, glutamic acid, glycine, leucine, isoleucine, methionine sulphoxide, proline, serine, threonine, valine and probably pipocolinic acid), an amino acid amide, sugars (glucose and fructose), one or two sugar phosphates, organic acids and many inorganic elements (aluminum, barium, calcium, chromium, copper, iron, magnesium, manganese, nickel, phosphorus, potassium, silicon, sodium, strontium, titanium and zinc).

Loss of amino acids and other ninhydrin positive substances was identified with as little as 15 minutes of seed soaking. Therefore, even a slight amount of soaking appeared to change the chemical composition of seeds. The amount of ninhydrin positive substances leached reached a maximum within 6 hours of soaking. With additional soaking up to 24 hours they increased somewhat in fully mature seeds but disappeared steadily if the seeds were a little immature. However, twice as much material leached out of immature seeds as out of fully mature seeds. On the other hand, concentration of inorganic elements increased in leachates up to 20 hours, following which reabsorption occurred. This reabsorption of inorganic elements coincided with the change to greater resistance of the seeds.

Results obtained suggested that those amino acids leached from the seeds occur free inside the seeds and were not due to protein degradation.

Evidence was obtained which showed the differentially permeable nature of the grain covering (pericarp + tests). Isolated embryo and endosperm leachates showed twice as many ninhydrin positive substances as in intact seed leachates. Moreover, additional sugars (sucrose and raffinose) were detected in embryo and endosperm leachates.

The concentration of solution used for seed soaking had a definite influence on the amount of ninhydrin positive substances leached from the seeds.

Pressure storage of X-irradiated seeds did not seem to effect the type and amount of substances lost from the seeds.

Microfilm \$2.00; Xerox \$4.40. 85 pages.

FACTORS INFLUENCING WATER ENTRY
THROUGH THE MICROPYLE IN PHASEOLUS
VULGARIS L. AND THEIR SIGNIFICANCE IN
INHERITANCE STUDIES OF HARD SEEDS.

(L. C. Card No. Mic 59-3155)

Jack Hiram Kyle, Ph.D. State College of Washington, 1959

Two experiments were undertaken to study the cause and inheritance of hard seeds in beans. The first one was designed to establish the principal area (or areas) of water absorption into beans of the two field bean varieties Great Northern and Red Mexican. A beeswax-paraffin mixture was used to seal the micropyle, hilum, and raphe areas of the testa. Each area was sealed separately and in combinations with each other. In the sealing test, beans of two micropyle classes of each variety were used to determine the rate of water absorption into beans with different sizes of micropyle. Micropyle classes were established by separating the beans into five micropyle sizes which ranged

from no opening (class 1) to the largest micropyle size of approximately 117 by 29 microns (class 5). Percentage of beans absorbing water in specified lengths of time were recorded. The data for both varieties were analysed as a 2<sup>4</sup> factorial. Water absorption in the Great Northern beans was directly proportional to the size of micropylar opening, whereas water absorption in Red Mexican beans was independent of micropyle size. The Red Mexican beans were more permeable in the hilum-raphe area.

The second experiment was designed to determine whether this difference between the permeability of the hilum-raphe areas of micropyle class 2 beans of the Great Northern, a white seeded variety, and Red Mexican, a red seeded variety, were genetically controlled. Beans of the micropyle class 2 of the two parents, F, and F, plants were used in absorption tests. The micropyle was sealed on all beans. The beans from the F1 plants were all colored beans and permeable in the hilum-raphe area like the red seeded parent. In the segregating F2 population all beans from plants which produced colored seeded beans were permeable to water in the hilum-raphe area, whereas all beans from plants which produced white seeded beans were impermeable to water to the same area. One-fourth of the total F2 population was white seeded. Populations were too small to determine if the same gene or two closely linked genes were involved.

Random populations of Great Northern beans were found to have a greater proportion of the beans with a large micropyle. On the other hand, Red Mexican beans were found to have a greater proportion of the beans with a small micropyle. This was also true for beans harvested from individual plants of both parents. The F<sub>1</sub> plants produced beans with a colored seed coat which were in the same frequency as the Red Mexican parent as to the size of the micropyle. The micropyle sizes of all colored beans in the F2 were in the same frequencies as occurred in the red seeded parent and the F1, whereas the micropyle sizes of the white seeded beans of this generation were in the same frequencies as the white seeded parents. There was a definite indication that the frequency of the beans in each micropyle class is also associated with the seed coat color as was the inheritance of permeability of the hilumraphe area. The size of the population was too small to draw definite conclusions as to whether the variations in micropyle size between sib lines from hybridizations between Great Northern and Red Mexican represent environmental or inherited differences. Progeny tests are needed for verification.

Classifying beans as to micropyle size and the use of a sealing technique to restrict the area of water absorption are proposed as effective methods in investigations of the causes and the inheritance of hard seeds.

Microfilm \$2.00; Xerox \$3.80. 66 pages.

STUDIES ON THE BACTERIAL SPOT OF TOMATO.

(L. C. Card No. Mic 59-3276)

Malepati Venkatarama Nayudu, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor J. C. Walker

The purpose of this investigation was to obtain information on host-parasite relationship of <u>Xanthomonas vesicatoria</u> (Doidge) Dawson and the tomato. The bacterium grew well in a basal medium containing vitamin-free casein hydrolysate or yeast extract, in potato extract plus 1% sucrose, and in nutrient broth. Nitrate medium supported little or no growth, and it was meagre in the ammonium medium. B Vitamin supplements to either of the media had no effect. Of 13 amino acids tested individually, aspartic and glutamic acids and glutamine supported moderate growth.

The disease progressed through 4 definite phases:
1) an early phase in which the lesions remained water soaked and enlarged to 1-2 mm diameter, 2) a middle phase in which the lesions turned brown, 3) a late phase in which the leaves turned chlorotic and showed epinasty and 4) the final phase in which the leaves dried and became brown and leathery.

In plants inoculated at different stages of growth it was found that the susceptibility of a leaf decreased with its age. This was correlated with decreased total and soluble nitrogen and increased polyphenol content in the older leaves. All the amino acids decreased in amount. Due to infection there was a marked increase in polyphenol content of the leaves, and the acidic compound C practically disappeared.

The disease developed most rapidly at 24°C, the temperature most favorable for good vegetative growth. The relative concentration of the amino acids was higher in plants grown at warmer temperatures and lower in plants at cooler temperatures. However, glutamic and aspartic acids occurred in relative abundance at both warm and cool temperatures.

Very low or very high levels of N, P, or K markedly retarded plant growth and the disease. The osmotic value of a nutrient solution with high levels of any one ion was very high and unfavorable for good plant growth. Plants grown in nutrient substrate with high osmotic values but otherwise balanced responded similarly. Low N plants contained only serine, alanine, y-aminobutyric, glutamic and threonine in recognizable quantities as noticed on paper chromatograms. In high and low K plants the relative concentration of glutamine, lysine, glycine, aspartic and glutamic acids and compounds A and C increased. In high and low P plants the relative concentration of leucineisoleucine, valine, serine, alanine, glutamic, threonine and compound C decreased. In the 4 treatments mentioned above citric acid and acidic compound A2 increased markedly in their relative amount. Sucrose increased in high and low K and in high P plants. It is suggested that the bacterium is exacting in its nutrient requirements and probably needs a certain balance of amino acids for good growth and successful pathogensis.

Microfilm \$2.00; Xerox \$4.80. 95 pages.

EFFECT OF TEMPERATURE ON PHYSIOLOGY AND STORAGE QUALITY OF PEARS.

(L. C. Card No. Mic 59-3411)

Stanley Wallace Porritt, Ph.D. Oregon State College, 1959

Major Professor: Elmer Hansen

A study was made of the effects of cooling rate and storage temperature on physiology and storage quality of Anjou and Bartlett pears grown in the Hood River and Medford districts of Oregon. Different cooling rates, typical of cooling in commercial storages, were used to reduce the temperature of the fruit to 30° F. in 2, 4, 6, 10 and 14 days. Other fruit was subjected to periods of delay of 2, 3, 4 and 6 days at 70° F. prior to storage at 30° F. In addition, fruit was held continuously at temperatures of 70°, 60°, 50°, 40°, 36°, 34°, 32°, 30°, and 29° F. Response of the fruit to the various treatments was determined by periodic ripening and examination of fruit, by analysis of certain chemical and physical properties, and by respiration studies on fruit at each temperature throughout the storage period.

Results throughout emphasized the dominating role of temperature in the post-harvest behavior of fruit. In general, storage life was reduced at an accelerated rate as temperature increased. Of practical importance is the large difference in storage life that was obtained by small differences in temperature near 30° F. Storage life of Bartlett pears, for example, was at least 40 per cent greater at 30° than 32° F. Contrary to some other results, the total amount of carbon dioxide respired during storage life diminished with rising temperatures.

Following harvest, a period of low metabolic activity persisted about 4 days in Bartlett and over 50 days in Anjou pears at 50° to 70° F. Anjou pears ripened normally at 70° F. only after a period of cold storage. Apparent lack of adverse effects accompanying delays in cooling fruit were associated with this period of low activity.

Intermediate temperatures encountered during periods of slow cooling produced more harmful effects on storage life than 2 to 3 days' exposure to 70° F. temperature followed by rapid cooling. Maximum storage life was obtained when fruit was cooled to 30° F. within 4 days of harvest.

Microfilm \$2.00; Xerox \$4.00. 72 pages.

TOLERANCES OF CERTAIN CITRUS SEEDLINGS TO FREE WATER IN SOIL.

(L. C. Card No. Mic 59-3553)

Rubert W. Prevatt, Ph.D. The University of Florida, 1959

Experiments were conducted in the laboratory and greenhouse at the University of Florida Citrus Experiment Station, Lake Alfred, to ascertain the tolerance of certain citrus seedlings, commonly used as rootstocks to free water in sandy soil. Leon fine sand, a poorly drained flatwoods soil type of vast acreage in Florida, was used as the soil medium. Because of the great demand for potential citrus land planting soils of this classification are now being considered as possible planting sites.

Seedlings of all varieties—Rough lemon, sour orange, sweet orange and Cleopatra mandarin—flooded for 12 months starting in January showed no visible symptoms of water injury. Seedlings flooded in April showed leaf symptoms of water injury after five weeks. All seedlings of all varieties flooded during June, July and August showed injury symptoms within two weeks.

All seedlings growing in subsoil showed water injury symptoms sooner than seedlings growing in topsoil when

flooded during the summer months.

All citrus seedlings tolerated free water in Leon subsoil to which dolomitic limestone had been added for a longer period than in the soil without added dolomitic limestone. Carrizo citrange, Troyer citrange, sour orange and Rough lemon seedlings were more tolerant of free water in both the limed and unlimed soil than sweet orange, Cleopatra mandarin and Rusk citrange seedlings.

The water in which citrus roots were incubated, and the water extracted from the waterlogged soil in metal cans in which there were citrus roots, contained toxic substances that caused all varieties of citrus seedlings to wilt and desiccate. The toxic substances were more detrimental to citrus seedlings in an acid aqueous medium than in a basic aqueous medium and were extractable with ethyl ether only from acid aqueous mediums. The toxic substances were thermostable and distillable. Aqueous solutions of the toxic substances possessed intense fluoresence.

The tolerance of citrus seedlings in waterlogged soil was found to depend on factors other than merely free water. Water-soluble toxic substances were apparently formed when citrus roots were bathed in water. These are apparently absorbed by the root system, translocated to the leaves, and cause seedlings to become yellow-veined, wilt and desiccate. Identification of the toxic substances has not been made.

Microfilm \$2.10; Xerox \$7.40. 159 pages.

A STUDY OF NATURAL AND RADIATION-INDUCED RECOMBINATION IN TRITICUM-AGROPYRON OCTOPLOIDS.

(L. C. Card No. Mic 59-3157)

Sardar A. Qureshi, Ph.D. State College of Washington, 1959

This study compares the results of two methods potentially useful for the improvement of kernel characteristics of Triticum-Agropyron octoploid derivatives, designated as SH 191 and SH 198, perhaps leading to the development of a new octoploid wheat species. These octoploids were selected in the wheat nursery at Pullman, Washington from wheat-Agropyron hybrid seeds obtained from W. J. Sando, U.S.D.A., A.R.S. The selections carry Agropyron disease resistance and are stable cytologically, but lack the seed size and quality characteristics of bread wheats. Seed size characters were found present in several other octoploids such as (T. timopheevi X T. polonicum)<sup>2</sup>, (T. timopheevi X T. orientale)<sup>2</sup>, and (T. timopheevi X T. dicoccum)<sup>2</sup> involving combinations of various tetraploid wheat species.

The <u>Triticum</u> octoploids were crossed with SH 191 and SH 198 in an attempt to produce recombinants carrying

disease resistance of Agropyron and kernel characteristics of Triticum species. Previous observations had indicated that greater than usual variablity could be in the progeny of a cross involving chromosomes of three or more species. At the same time, Agropyron disease resistance was known to be conditioned by one or more of the seven unpaired chromosomes observed in meiotic cells of hybrids between octoploid (SH 191 or SH 198) and hexaploid wheats. Therefore, it seemed that a means of enforced recombination would be necessary if the desired segments from these univalents were to be retained in the wheat background. Accordingly, hybrid F<sub>0</sub> seeds were also irradiated with X-rays and neutrons.

The hybrid seeds were shriveled, but remarkably good emergence and survival was attained from the irradiated, as well as non-irradiated F<sub>0</sub> seeds. However, as could be expected from such complex hybrids, only semi-fertile to completely sterile plants were obtained. Out of seven hybrid combinations, two (T. timopheevi X T. orientale)<sup>2</sup> X SH 191 and SH 198 produced no seed in any treatment. The semi-fertile plants from the irradiated seeds yielded fewer seeds than the controls. The lower seed set was related to a higher frequency of univalents and multivalents in the radiation treatments.

Multivalents were consistently higher following radiation treatments in both  $M_1$  and  $M_2$  generations. However, this was accompanied by certain phenotypic expressions in  $M_2$  progenies, since (1) there were more classes of recombinants than found in controls, and (2) a higher frequency of the desired classes of recombinants than were observed in the controls.

The sum of the parental gametes--56 chromosomes--was observed only in the sporocytes carrying a higher number of multivalents. This retention of the parental sets of chromatin through induced translocations, therefore, appeared to explain the higher frequency of recombinants carrying wheat-Agropyron characters with wheat-like kernels at the octoploid level. Plants with wheat-like kernels obtained as natural recombinants from the non-irradiated hybrids had lost some chromosomes, as a maximum chromosome number of 52 was observed.

Neutrons were more effective than X-rays for inducing interchanges. The interchange frequency for plants exposed to the two radiations was from 1.00 to 1.14 and .43 to 1.01, respectively. The higher interchange frequencies and the greater range of recombinant classes in the radiation treatments was interpreted as evidence for greater promise of success in synthesizing desirable recombinant at the 56 chromosome level than offered by conventional breeding techniques. The establishment of a desirable cytologically stable and fertile octoploid, however, may require several generations of selection.

Microfilm \$2.00; Xerox \$4.20. 77 pages.

THE GERMINATION OF VEGETABLE AND FIELD CROP SEEDS AS AFFECTED BY TWO SOIL FUMIGANTS.

(L. C. Card No. Mic 59-3562)

Bommareddy Ranga Reddy, Ph.D. The University of Florida, 1955

The expanded use of soil fumigation for the control of root-knot nematodes, which has often resulted in an increased production of vegetable crops, has given rise to several problems. Work was initiated in 1953 on a study of the effect of the volatile soil fumigants, dichloropropenedichloropropane (D-D) mixture and ethylene dibromide (Dowfume W-40), on the growth of seedlings and the germination of seeds. Experiments were conducted in the laboratory, greenhouse, and field plots both in soil and soilless mediums. Results indicated that the germination of most seeds tested was inhibited in the presence of fumigants. Evidence was found that the vapors of these fumigants are partly absorbed by water and change its pH. Use of exposed water for culture of seeds resulted in decreased germination. Aeration of exposed water for two weeks reduced the toxicity but failed to revert the pH to normal. The germination of dry seeds was decreased at the higher concentrations and longer periods of exposure to fumigants, but subsequent aeration for ten days after exposure helped to restore germination to a normal level. High moisture content of seeds was found to be an important factor in reducing germination of fumigated seeds. Toxicity of the fumigants was found to be greater with increase in humidity and temperature. The critical humidity and temperature for pronounced damage to seeds depended upon the inherent susceptibility of the specie of seed tested. At soil temperatures higher than 68°F. the toxicity to germinating seeds was reduced by rapid volatilization and escape of the fumigants. The use of a water seal immediately after fumigation increased the toxicity of the fumigants, especially at the higher rate of water application. The toxicity of the fumigants was found to be greater in sandy loam soils than in sandy soils. In all tests conducted the fumigant, dichloropropene-dichloropropane mixture reduced the germination of seed more than ethylene dibromide; however, the latter was found to be more toxic to transplanted tomato seedlings. In general, the relative susceptibility of seeds to fumigants varied with the type and concentration of fumigant, specie of seed and existing environmental conditions. Microfilm \$2.25; Xerox \$7.80. 169 pages.

NATIVE FIXED AMMONIUM AND FIXATION OF APPLIED AMMONIUM IN SEVERAL WISCONSIN SOILS.

(L. C. Card No. Mic 59-3233)

Leo Marcellus Walsh, Ph.D. The University of Wisconsin, 1959

Supervisor: Assistant Professor J. T. Murdock

The objectives of this study were to modify the HF procedure for determining fixed ammonium, to determine the amount of native fixed ammonium in Wisconsin soils,

to measure the amount of applied ammonium fixed under moist, frozen, and oven-dry conditions by Wisconsin soils, and to determine the availability of fixed ammonium to higher plants.

Laboratory studies indicated that a N HF:N HCl mixture effectively removed all the fixed ammonium from vermiculite or soil when a 100:1 solution:clay ratio or a 40:1 solution:soil ratio was employed and when the samples were continuously agitated for 24 hours. It was necessary to pretreat soils with hot N KOH to prevent release of organic nitrogen compounds during extraction. A colorimetric Nessler's method was used to measure the fixed ammonium released. This modified HF procedure was used for determining fixed ammonium in all subsequent studies.

In a second laboratory study a number of Wisconsin soils were analyzed for native fixed ammonium. Also, fixation of applied ammonium under moist, frozen, and oven-dry conditions was measured. The results of these studies indicated that most of the soils analyzed contained substantial amounts, generally 0.5 - 1.0 me. per 100 g., of native fixed ammonium. Nearly all of the soils included in this study fixed small amounts of applied ammonium under moist conditions. The surface and subsoil horizons fixed an average of 0.08 and 0.15 me. per 100 g., respectively. About twice as much fixation occurred when the soils were frozen. Substantially more ammonium was fixed, 0.5 - 1.0 me. per 100 g., when the soils were ovendried  $(55^{\circ}$  C.).

The Ap and Bl horizons of a Dodge silt loam were used in greenhouse experiments to study the fixation of applied ammonium, the effect of freezing, and the availability of fixed ammonium. By applying potassium and nitrogen to either the same or separate layers of soil in the pots it was possible to evaluate the effect of potassium on the release of fixed ammonium. When ammonium and potassium were applied in the same layer of soil, the  $A_p$  and  $B_1$ horizons of this soil fixed five and 15 percent of the added ammonium, respectively. Freezing increased the amount of fixation appreciably. However, when ammonium and potassium were applied to separate layers of soil, very little ammonium was fixed against crop removal. Highly significant correlations between moist exchangeable potassium after cropping and the amount of applied ammonium fixed against crop removal showed that the activity of potassium in the soil controlled the release of fixed ammonium to the crop.

Two methods were used to determine the amount of applied ammonium fixed against crop removal; namely, HF extraction of fixed ammonium after cropping and crop uptake from differential nitrogen treatments. A highly significant correlation existed between these two methods, therefore, it was concluded that differences in crop uptake from differential nitrogen treatments were due to ammonium fixation.

Greenhouse studies indicated that about 15 percent (0.12 me. per 100 g.) of the native fixed ammonium in the  $B_1$  horizon was released when the activity of fixable cations in the soil was very low. However, very little native fixed ammonium was released from the  $A_p$  horizon, presumably because sufficient potassium remained in this horizon to block release of fixed ammonium.

The overall results of laboratory, greenhouse, and field studies indicate that small amounts of applied ammonium can be fixed by many Wisconsin soils. However,

nearly all of this fixed ammonium is available to crops when the level of exchangeable potassium is low. These studies also indicate that even under the most advanta-

geous conditions very little of the native fixed ammonium is available to crops.

Microfilm \$2.00; Xerox \$6.40. 131 pages.

#### ANATOMY

NEUROANATOMY OF THE BRACHIAL PLEXUS OF THE DOG.

(L. C. Card No. Mic 59-3372)

John Gilbert Bowne, Ph.D. Iowa State College, 1959

Supervisor: Dr. Robert Getty

The origin of the brachial plexus and its component nerves were dissected in fifty-two dogs. Four different combinations of origin were recorded. The sixth cervical through the second thoracic spinal nerves was observed in 55.71% of the dissections.

The response to faradic stimulation of the various nerves of the brachial plexus was photographed using both slow motion and still techniques. The results helped to functionally catagorize the various nerves of the plexus in relation to the evaluation of the attitudes obtained when various neurectomies were performed on the nerves of the plexus. Faradic stimulation of the anastomotic branch between the musculocutaneous and median nerves indicated that the sixth and seventh cervical nerves furnish motor innervation to the flexors of the carpus and digits. This was also proved by degeneration studies. Stimulation of the lateral thoracic nerves was found to cause contraction of the preputial muscle.

The ventral roots of the sixth cervical through the first thoracic spinal nerves were resectioned on separate individuals and the resulting Wallerian degeneration studied in the various nerves of the plexus. The radial nerve was found to contain degenerating motor fibers when each ventral spinal root was resectioned. The first thoracic spinal nerve was found to furnish motor nerve fibers to the axillary nerve.

Neurectomies were performed on the musculocutaneous, axillary, and median-ulnar nerve trunks on separate individuals with no observable symptoms. When only the radial nerve was resectioned, the forelimb was characteristically held with the elbow and carpal joints flexed. The forearm was held horizontal to the surface of the ground. The limb could not support the animal's weight. Resection of the musculocutaneous and radial nerves in the same animal caused paralysis of the extensors and flexors of the elbow joint as well as the extensors of the carpus and digits. The characteristic attitude assumed by the injured limb was one in which the elbow joint was not flexed. The shoulder joint was held in a flexed position and the forearm hung perpendicular to the surface of the ground. No weight could be borne by the affected limb. The characteristic attitude of the resection of the musculocutaneous, radial, axillary and thoracodorsal nerves was one in which the shoulder was extended, the elbow dropped and the dorsal surface of the carpus and digits were on the ground. The latter combination of experimental neurectomies simulated clinical cases photographed. In the above neurectomies simulated clinical cases photographed. In the above neurectomies the affected limb could be advanced by the brachiocephalicus, supraspinatus and infraspinatus muscles. However, when the brachiocephalic and suprascapular nerves were resectioned in addition, the limb could no longer be advanced. Resection of the spinal nerves as they emerged from the intervertebral foramina caused symptoms similar to those seen when the nerves originating from the respective spinal nerves were resectioned. The animal was unable to advance the limb when the sixth through the eighth cervical spinal nerves were resectioned, however, it could still support weight on the affected limb. Six months following the neurectomy, the antagonist tendons had contracted and the limb could not be advanced enough to place the volar surface of the paw on the ground. Resection of the seventh and eighth cervical and first thoracic spinal nerves caused symptoms similar to those seen when the musculocutaneous, radial, thoracodorsal and axillary nerves were resectioned. When the sixth cervical through the first thoracic spinal nerves were resectioned, the lifeless condition of the limb as described by some clinical observers was reproduced.

The sequellae seen six months after the various neurectomies depended on the importance of the nerves involved. Atrophy of the denervated muscles started within ten days and reached a maximum in three months. The tendons of the muscles that were antagonists to the denervated muscles contracted very quickly. If the sensory nerves were also abolished in the affected limb, the animal often performed self-amputation.

The various clinical attitudes of brachial plexus paralysis have been simulated, recorded and studied by experimental neurectomies.

Microfilm \$2.45; Xerox \$8.60. 186 pages.

INFLUENCE OF CERTAIN HORMONES ON NUCLEIC ACID METABOLISM BY LYMPHOCYTES.

(L. C. Card No. Mic 59-2987)

Truls Brinck-Johnsen, Ph.D. University of Utah, 1959

Chairman: Thomas F. Dougherty

Our knowledge regarding the hormonal influence on nucleic acid metabolism of lymphocytes is limited to reports dealing with the incorporation of Phosphorous-32 into these substances. It is recognized by most investigators that the use of P-32 involves considerable error.

In this investigation an attempt was made to study some of the endocrine aspects of nucleic acid biosynthesis as studied by the incorporation of adenine-C-14. Particular emphasis was placed on the effects of cortisol and ACTH.

The methods involved a tissue fractionation of lymphatic tissue to obtain RNA and DNA, as well as paper chromatography of the hydrolyzed nucleic acid fraction to separate pure adenine and guanine for quantitative estimation and isotope measurement. This analytical procedure proved to be acurate and reproducible, and it is felt that reliable conclusions can be reached using these methods.

In the present investigation the uptake and prolonged retention of adenine-8-C-14 by lymphatic tissue of mice was demonstrated. The experiments bring support to the idea that the nucleic acids of dead lymphocytes are reutilized during heteroplastic lymphocytopoiesis.

Tumor tissue has been shown to retain less of the radioactive labelled nucleic acids than normal tissue, and this is interpreted as an impairment of the reticulo-endothelial system involved in heteroplastic lymphocytopoiesis.

Cortisol causes a depletion of nucleic acids as well as an inhibition of the biosynthesis of nucleic acids in the intact animal. Conclusive evidence has therefore been presented in support of earlier histological findings that cortisol not only destroys cells but also inhibits cell proliferation. ACTH in the intact animal has an effect similar to cortisol, probably due to its known function as an adrenal cortical stimulating agent.

Adrenalectomy does not cause a general increase in nucleic acid biosynthesis in the lymphatic tissues. In fact, out findings imply that the absence of the adrenals will cause an inhibition particularly of the RNA biosynthesis. It is concluded that adrenal cortical hormones might stimulate certain aspects of nucleic acid metabolism. In the absence of the adrenals this stimulatory effect of cortical hormones was more conclusively demonstrated. Cortisol in the adrenalectomized animals inhibits the biosynthesis of DNA in lymph node and thymus but will markedly stimulate the adenine-8-C-14 incorporation by RNA of these tissues as well as that by both nucleic acids of the spleen. This is considered as conclusive evidence that adrenal cortical hormones do stimulate certain aspects of nucleic acid biosynthesis.

A profound extra-adrenal effect of ACTH was demonstrated in adrenalectomized animals. ACTH will markedly stimulate biosynthesis of both RNA and DNA in all lymphatic tissues studied.

Glycine-C-14 was not similarly affected by ACTH in the adrenalectomized animal. Support for the idea that glycine follows a different pathway of incorporation than that of adenine was therefore obtained.

In the tumor bearing animals cortisol had a less profound effect than in normal intact animals. Cortisol inhibited the biosynthesis of RNA in the tumor but clearly enhanced the biosynthesis of both nucleic acids in spleen and thymus. It is speculated that since these effects resemble the effects of cortisol in adrenal cortical animals, the tumor bearing animal might have an adrenal cortical insufficiency.

The implications of these findings and interpretations have been further discussed.

Microfilm \$2.00; Xerox \$6.60. 139 pages.

THE CHRONIC EFFECTS OF PLUTONIUM-239
ON MINERALIZED TISSUES AS STUDIED BY
RADIOGRAPHIC, AUTORADIOGRAPHIC, MICRORADIOGRAPHIC, CELLOIDIN AND INDIA
INK-GELATIN INJECTION TECHNIQUES.

(L. C. Card No. Mic 59-3305)

Webster Shew Shun Jee, Ph.D. University of Utah, 1959

Chairman: Thomas F. Dougherty

Early and late changes to mineralized tissues were observed in 31 young adult beagles injected with 0.0142 to 3.0 µc/Kg of plutonium-239 a bone seeking alpha emitter, using celloidin, radiographic, microradiographic and autoradiographic techniques, The impairment of vascular supply to bone was studied by india ink vascular injection of the hind-limb at autopsy. The sequence of bone and teeth changes was studied in 15 serially sacrificed dogs injected with 3.0 μc/Kg of plutonium. Radiographic studies of disarticulated, defleshed bones showed the incidence and location of fractures and bone tumors as well as the early changes in trabecular bone (smudged or thickened) and late changes in cortical bone (thinned, thickened, zones of rarefaction and roughened surfaces). The gross and microscopic distributions of plutonium before and after normal and/or pathologic bone remodelling were described. The bone existing at the time of injection was identified by its heavy surface concentration of plutonium, while new bone deposited after injection was identified by its diffuse labelling.

The sequence of the development of histopathologic changes in the skeleton injected with 3.0  $\mu c/Kg$  of plutonium (5-level) was described as follows:

- A. Early change in the disturbance of endochondral bone growth resulting in the formation of hot line in rib (1-28 days).
- B. Early changes at trabecular surfaces and endosteal surfaces of cortical bone:
  - (1) destruction of endosteal cells (1 week).
  - (2) death of osteocytes within the range of plutonium alpha (2 months).
  - (3) formation of fibrosis (2 to 3 months).
  - (4) occurrence of abnormal resorption (3 months).
- C. Late changes in cortical bone:
  - (1) formation of haversian canal plugs (1 year).
  - (2) death of osteocytes in affected osteones and adjacent interstitial lamellae (2 yrs.).
  - (3) formation of large resorption cavities in excessive number (2 1/2 yrs.).
  - (4) formation of abnormal haversian systems (2 1/2 yrs.).
  - (5) occurrence of periosteal bone resorption and fibrosis (2 1/2 yrs.).
  - (6) occurrence of sponaneous fractures in ribs and spinous processes (2 1/2 yrs.).

D. Still later change in the formation of osteogenic sarcoma (3 1/2 yrs.)

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The histopathologic changes in trabecular bone of the 4- and 4- level dogs were found to be different than in 5-level dogs. The 4-level dogs formed predominately mosaic trabeculae, while the 3-level dogs formed mosaic trabeculae only at the metaphyses of long bone. The abnormal haversian systems were both abnormal in morphology and mineralization. The spontaneous fractures were generally restricted to hot line, rib and spinous processes. The first fracture occurred at the hot line after 400 days post-injection. The distribution, latent period and incidence of osteogenic sarcoma were described. The bone tumors generally arose from sites rich in trabecular bone. The 5-, 4- and 3-level dogs surviving over 1100 days all developed osteogenic sarcoma. The early changes at the sites of endochondral bone growth, trabecular surfaces and endosteal surface of cortical bone were the result of direct irradiation. These sites were the location of the heaviest concentration of activity. The loss of bone cells in cortical bone was found to be secondary to the disturbance to the vascular supply of bone.

Autoradiographic study of teeth containing plutonium had found the activity to be most concentrated at the dentine surface, and surfaces of the inner wall of the alveolar bone and the cementum outlining the periodontal ligament. Radiographic studies of teeth and mandible showed the disorganization and smudging of trabecular bone in the mandible, followed by loss of the space for the periodontal ligament, bone and tooth resorption and the loss of tooth. The sites and sequence of histopathologic changes in teeth and their supporting structures in dogs injected with 3.0  $\mu$ c/Kg of plutonium (5-level) were described as follows:

- A. Pulp cavity (odontoblasts).
  - (1) no effect.
  - (2) proliferation of secondary dentine at restricted sites (1 month).
- B. Root (cementum and dentine).
  - (1) loss of cementoblast adjacent to acellular cementum (3 months).
  - (2) resorption of acellular cementum and dentine (3 months).
  - (3) resorption of cellular cementum and dentine (6 months).
  - (4) replacement with bone, cementum orgingiva and formation of secondary dentine (3 to 6 months).
  - (5) proliferation of basophilic staining cementum (9 months).
- C. Periodontal ligament
  - (1) loss of vascularity (1 yr.).
  - (2) loss of organization (non-functional; 2 1/2 yrs.).
  - (3) loss of teeth (3 yrs.).
- D. Alveolar bone (tooth socket)
  - (1) resorption of alveolar crest (3 months).

- (2) resorption of basal bone (6 months).
- (3) proliferation of bone resulting in bonycementum or dentine union (ankylosis; 6 months).

The teeth changes were the result of both direct and indirect effect of irradiation. The indirect effect was due to injury to blood vessels.

Comparative toxicity studies of 5-, 4-, 3-, 1.7, and 1-level dogs showed the bone and teeth changes were dose dependent. Microfilm \$3.25; Xerox \$11.20. 251 pages.

THE MAMMALIAN "PAIN TRACT" IN PHYLOGENY:
A COMPARATIVE NEURO-ANATOMICAL STUDY OF
THE CONNECTIONS OF SPINAL FIBERS ASCENDING
IN THE FASCICULUS ANTEROLATERALIS OF THE
MARSUPIAL, RODENT, LEPORIDA,
CARNIVORE AND PRIMATE.

(L. C. Card No. Mic 59-3017)

William Raphael Mehler, Ph.D. University of Maryland, 1959

Supervisor: Walle J. H. Nauta, M.D.

A previous study of the spino-thalamic system in the monkey (Mehler, Feferman and Nauta '56) revealed a related system of spino-reticular fibers ascending in the antero-lateral fasciculus of the spinal cord. These fibers in their course through the brain stem reticular formation terminate profusely throughout the majority of the reticular subdivisions recognized by Olszewski and Baxter ('54) and therefore were identified as a "medial spino-reticular system". In a subsequent study of ascending pathways in the cat (Nauta and Kuypers '58), some interspecific differences were observed in the density of the spino-vestibular connections. It was suspected, therefore, that similar studies of mamals below the carnivores might reveal other, possibly more significant phylogenetic changes.

Extending the foregoing experiments to a representative phylogenetic sample of mammals: 3 opossums, 3 rats, 1 rabbit and 3 chimpanzees, a comparison of the findings with the monkey and cat material revealed a phylogenetically related system of spino-reticulo-thalamic fiber connections in each species. The medial course of this system was most pronounced in the marsupial and rodent, but comparable terminal degeneration was observed in all species in the bulbar and pontine reticular nuclei cited in the original studies on the monkey. More rostrally in the brain stem, terminations of ascending spinal fibers were observed in the superior colliculus and central gray midbrain substance. Closer examination revealed that although this connection appeared to be more massive in the lower forms, the apparent disproportion was largely mirrored by phylogenetic increases in the volumes of adjacent regions of the midbrain in the higher forms.

The number of spinal fibers reaching the thalamus and terminating in the nucleus ventralis posterior lateralis or its phylogenetic homologue, on the other hand, showed a true phylogenetic increase. In relative figures, this increase can be expressed numerically as follows: 2% of the volume of fibers in the pars superficialis of the

fasciculus antero-lateralis in the opossum, 5% in the rat, 10% in the cat, and 20% and 30% respectively in the monkey and chimpanzee.

Spinal fibers terminating in certain intralaminar thalamic nuclei in all of the species examined were found to represent another constant mammalian spino-thalamic connection. However, the more medial tegmental pathway followed by these fibers en route to the thalamus in the lower forms contrasts strongly with the more lateral trajectory — enclosed in the classical spino-thalamic tract — found in the primates. These findings thus demonstrate, apparently for the first time, that morphologically true spino-thalamic fibers are present in species as low as the rodent and marsupial.

These differences in the course of spinal fibers ascending to the thalamus, as well as variations observed in the mode and density of spinal fibers to the inferior olive and vestibular nuclei of the different species, illustrate that, although the majority of spinal connections with the brain and thalamus are homologus throughout the mammalian

scale, certain progressive interspecific changes in the distribution of the classical ascending spinal tracts can be demonstrated. While some of the differences observed are only relatively minor, the present study has produced evidence of at least one apparent phylogenetic end-point: the seemingly complete absence of spino-olivary connections in the chimpanzee could be interpreted as the ultimate loss of a fiber connection present in the monkey, and in all of the lower mammalian species.

The fact that the great majority of ascending spinal fibers in mammals consistently terminate at levels caudal to the thalamus is presented as evidence against the tradition to identify the mammalian "pain tract" with the spinothalamic component. The multiplicity of the connections established by fibers of the anterolateral spinal fasciculus, therefore, suggests the possibility that the central pain pathway is represented by fiber systems other than the classical spino-thalamic tract.

Microfilm \$2.00; Xerox \$4.00. 71 pages.

#### ANTHROPOLOGY

AN EVALUATION OF THE PHASE CONCEPT IN SOUTHWESTERN ARCHAEOLOGY: AS APPLIED TO THE ELEVENTH AND TWELFTH CENTURY OCCUPATIONS AT POINT OF PINES, EAST CENTRAL ARIZONA.

(L. C. Card No. Mic 59-2980)

Alan Peter Olson, Ph.D. University of Arizona, 1959

Supervisor: Emil W. Haury

During the summers of 1949 through 1953, 1957, and 1958, four sites were excavated at Point of Pines, Arizona. This was part of an extensive program which was carried out under the auspices of the Arizona Archaeological Field School, which is located on the San Carlos Indian Reservation. Surface indications at these sites suggested an occupation during the eleventh and twelfth centuries, representative of the Reserve and Tularosa phases, for which information in the local chronology was lacking.

Arizona W:10:56 and 57 were placed in the Reserve phase while Arizona W:10:37 and 65 were classified as Tularosa phase sites. The former pair of sites provided information on 24 rooms in an early masonry pueblo, six pithouses of the same time period, and a rectangular masonry-faced, semi-subterranean kiva. Arizona W:10:37 and 65 were both large Tularosa pueblo phase sites; 23 rooms and seven kivas were investigated. The masonry architecture showed a development from the Reserve phase; the kivas at these two sites are most interesting for their diversity in form and internal features. These four sites provided a large number of objects which allowed a reconstruction of the material aspect of culture of these people.

The phase concept, one of the most useful taxonomic devices for the classification of archaeological cultures, was traced in the Southwest from its inception in the early

1930's to the present. This device was examined in both conceptual and operational terms through its historical development. The relationship of this element to classificatory schemes of a higher order of synthesis was described and the concept was defined in terms of contemporary taxonomic usage.

H. S. Gladwin, Through the work of Gila Pueblo, was the first student to make extensive use of the concept, applying it widely through the Southwest. The Museum of Northern Arizona, under the direction of H. S. Colton, made extensive use of this device in the Flagstaff region. P. S. Martin and his associates have defined a long phase sequence in the Reserve, New Mexico, region; several other students have defined phases in regions lying outside the sphere of influence of the Pecos classification.

The use of ceramic taxonomy as the major determinant in phase assignment is evident in these various applications. The formation of these units has been obscured by the lack of a clear separation of the relationship of cultural content, space, and time in the formulation of specific phases. It is obvious that ceramic indicators are most effective in terms of the spatial and temporal definition of phases, but that pottery has been overemphasized in its application as a device used in cultural synthesis.

The material from these excavations at Point of Pines was described in terms of this concept. The Reserve and Tularosa phases were geographically limited to the region centered on the White Mountains in Arizona, and on the upper reaches of the various rivers which rise in this mountain mass. The regions from which the majority of evidence was drawn were those of Point of Pines, Arizona, and Reserve, New Mexico.

The temporal span of the Reserve phase was estimated at A.D. 1000 to 1150. Around 1150 there was a period of time when neither Reserve nor Tularosa Black-on-white was in a definite majority. The recognition of Tularosa

Black-on-white as the dominant decorated type, and hence the beginning of the phase, was placed after 1150. The termination of the Tularosa phase was dated at A.D. 1175.

During these two phases, changes were made in the material inventory, mainly as a result of contact with regions to the north. Pithouses were contemporary with masonry pueblos; great and small kivas were present, the latter showing a wide range in architectural form. The economy of these people was centered on farming with a secondary emphasis upon hunting and collecting; the tools necessary for this economy showed little change during the two phases. The material inventory during these two phases was extensive, but mainly oriented toward utilitarian pursuits; aesthetic considerations did not show as high a development.

Microfilm \$8.15; Xerox \$27.80. 641 pages.

NAPASKIAK: AN ESKIMO VILLAGE IN WESTERN ALASKA.

(L. C. Card No. Mic 59-3029)

Wendell Hillman Oswalt, Ph.D. University of Arizona, 1959

Supervisor: Edward H. Spicer

The aims of this dissertation are to describe the ecological setting, society, and culture of one contemporary Eskimo community and, by utilizing the results of the village study, to broaden and make more meaningful the classifications of "primitive" peoples.

The Eskimo community selected for a year-long study, during A.D. 1955-1956, was the village of Napaskiak, which is located along the lower Kuskokwim River in western Alaska. The one hundred and forty persons of Napaskiak proper and the forty others living at nearby Oscarville constituted the unit of analysis. These people rely on salmon as their most important staple. They trade mink and muskrat pelts for food and American manufactured goods. Their cash income is derived from welfare funds and wage labor. Virtually everyone is a member of the Russian Orthodox church and participates in religious activities. Orthodox beliefs have virtually replaced the aboriginal Eskimo belief system. Since 1939 a community school has been maintained by the Alaska Native Service. The school teacher serves as the primary link between the villagers and the Federal and Territorial governments. The village has organized an informal, elected council composed of most adult males. They are active in crises situations but are not a regularly functioning governing body.

The nuclear family, which is the primary subsistence and household unit, is the focal point of everyday village life. Leisure time activities center about visiting, viewing motion pictures, and taking steam baths. An overall view of the community indicates that the nuclear family is the most important social unit, and other ties of kinship, while important, are not emphasized. Feelings of community unity are rather rare, and cooperation apart from that involved in church activities is unusual.

The second section of the dissertation concerns the place of the Napaskiak findings within the broad classifi-

cations of cultures and societies. Particular attention was given to sociocultural integration as an index into social and cultural complexity. Current classifications with integration as a central concern are the folk-urban continuum of Robert Redfield and the community pattern concept of Richard Beardsley and his associates. The Napaskiak data could be fitted into these classifications only after the folk concept had been expanded and the community pattern types had been more clearly defined on the basis of integration. The key concept of integration has been defined by John Gillin, who points out that relatedness, functional linkage and consistency are the essence of integration. The units that may or may not be integrated are the traits, trait complexes, and activities. To these were added sub-systems which are assemblages of related, functionally linked and largely consistent activities. Napaskiak has four major sub-systems: subsistence, kinship, Russian Orthodox beliefs, and the steam bath. These are not highly integrated with one another. Such a sociocultural setting stands in contrast to the folk of Redfield which are highly integrated. For this reason, non-integrated societies were designated as family folk; these are exemplified by the Nevada Shoshoni, Siriono, Chipewyan, Ona and Napaskiak Eskimos. These peoples are contrasted with integrated or community folk societies, which are represented by such peoples as the Camayura and the Hopi. Finally, it was determined that societies with the Restricted Wandering or Central-Based Wandering community pattern are family folk, while those that are Semi-Permanent Sedentary or of the undifferentiated variety of Simple Nuclear Centered community type are community folk. The remaining community pattern types are urban. The final typology permits the classification of primitive societies into the folk-urban continuum and a refinement of the community pattern types for a more meaningful division within each type and between Microfilm \$4.65; Xerox \$15.60. 361 pages.

THE DENTAL MORPHOLOGY OF THE POINT OF PINES INDIANS.

(L. C. Card No. Mic 59-3030)

Richard Gerald Snyder, Ph.D. University of Arizona, 1959

Supervisor: Frederick S. Hulse

A study of specific morphological features of the dentition has been completed on 3019 permanent teeth and 658 deciduous teeth from 350 prehistoric Indians from the Point of Pines area, Arizona.

An attempt was made to 1) define the odontological characteristics of this population, 2) determine affinities with other populations, and 3) establish, on the basis of incidence of these features, genetic relationships between two temporally separated peoples; the earlier Reserve-Tularosa Phase individuals of A.D. 1100-1250 (from Jewett Gap (Gallo) Pueblo, Higgins Flat Pueblo, Turkey Creek Pueblo, Apache Creek Pueblo, and Arizona W:10:37), and later post Tularosa people (from Point of Pines Ruin, Arizona W:10:51, Arizona W:10:52) who inhabited the area from A.D. 1250-1450 chiefly during the Point of Pines Phase.

As a result the Point of Pines Indian population can be odontologically characterized as having:

- 1. shovel-shaped incisors.
- 2. an extremely low incidence of Carabelli's Anomaly (0.8%, including both pits and cusps).
- 3. a low incidence (5.9%) of torus mandibularis.
- 4. a high incidence (75.6%) of 5 cusped lower third molar teeth.
- 5. a low incidence of Y5 occlusal cusp pattern (48.7%) of the lower first molar tooth.
- a mean depth of the lingual sulcus (shovel-shape)
  of 1.4 millimeters for the upper central incisors,
  1.25 millimeters for the upper laterals, 0.6mm for
  the lower centrals, and 0.7 mm for the lower lateral
  incisors.
- 7. a mean depth of the labial sulcus (double shovel-shape) of 0.3 mm, with a range up to 0.8 mm.
- 8. no statistically significant differences between left and right corresponding teeth in regard to mean size.
- 9. a higher mesiodistal variability in the upper first molar than third molar.
- 10. a higher buccolingual diameter variability in the upper first molar than second molar.
- 11. a relatively high incidence of double shovel-shape trait (22.5%) of the incisor teeth.
- 12. a low incidence of caries (4.6%), only 5 cases of tooth crowding, and 11 cases of tooth impaction.
- 13. a 6.5% incidence of a previously unreported character, the three-quarter double shovel-shape, or mesial lateral ridging of the labial surface of incisor teeth.
- 14. some presence of supernumerary teeth in incisor, premolar, and molar groups.
- 15. an extremely low incidence of congenital absence (4.0% of 172 individuals) of the third molar.
- 16. rapid tooth wear, which although variable, was most typically severe.

They were found to differ in some traits from all other prehistoric Indian populations with whom they were compared. They were also found to be distinctive from modern Pima Indians in regard to a lower incidence (48.7%) of the ancestral Y5 pattern on the first lower molar, and in that no protostylid cusps were found on the lower first molar. It is hypothesized on this basis that the modern Pima Indians are not descendants of the Point of Pines Indians.

Statistically significant differences were found between the Tularosa people and post-Tularosa people of the Point of Pines population in regard to six traits. There was more severe tooth wear in the earlier population; greater incidence of double shovel-shape in the Later population; as well as reduction of molar cusp pattern from  $M_1$  -  $M_3$  in the Earlier population, and  $M_1$  -  $M_3$  -  $M_2$  on the post-Tularosa people. No hypodontia of the second premolar or of the incisors occurred in the Early people, and three specific tooth dimensions differed. On the basis of two traits apparent in post-Tularosa people but absent in the

Early population (congenital absence of incisors, and premolars), both of which have been shown to be genetically based, it is concluded that a third population came into the Point of Pines area prior to A.D. 1265.

This study has resulted in the discovery of a new morphological character, the three-quarter double shovel-shape feature, found on the mesial-lateral border of the labial surface of incisor teeth in this population.

Utilizing Coon's (1954:31) definition of a population as a "group of people, unified by interbreeding, and forming a geographical and social unit" it is believed that evidence presented that demonstrates the genetic continuity of the Early Reserve-Tularosa people with Later Pinedale-Point of Pines Phase people. Evidence has been presented that shows that between A.D. 1265-1405 admixture with new peoples had occurred, on the basis of the appearance of new morphological features in the dentition.

Microfilm \$4.50; Xerox \$15.00. 349 pages.

CULTURAL IMPLICATIONS OF STYLE TRENDS IN SOUTHWESTERN PREHISTORIC POTTERY:

BASKETMAKER III TO PUEBLO II IN WEST CENTRAL NEW MEXICO.

(L. C. Card No. Mic 59-3049)

William Warwick Wasley, Ph.D. University of Arizona, 1959

Supervisor: R. H. Thompson

Ceramic material recovered during the excavation of the Cerro Colorado site near Quemado in west central New Mexico, under the direction of the Peabody Museum, Harvard University, has been analyzed in terms of the normal techniques for differentiating pottery types and ceramic varieties. This analysis was used as the basis for dating the occupation of this site from about A. D. 600-1100 and for building an internal chronology based on five ceramic periods.

Relating the pottery from Cerro Colorado to the ceramics of adjoining areas was accomplished partly through an assessment of Cerro Colorado trade relationships, partly through the definition and discussion of styles of design, and partly through the formulation of stylistic traditions and ceramic technological traditions. A style of design is a particular manner of ceramic decoration with characteristics which distinguish it from all other manners of ceramic decoration. The nine styles represented in the pottery of the Cerro Colorado site are: Lino, Kana-a, Black Mesa, Sosi, Dogoszhi, Puerco, Tularosa, Dos Cabezas, and Three Circle. This use of the concept of style of design has given additional perspective to the position of Cerro Colorado village in the cultural prehistory of the Southwest.

It was possible to group seven of the styles of design into three stylistic traditions. A stylistic tradition consists of two or more styles of design which are sequent in time and developmentally related. The three stylistic traditions defined are Kana-a and Tularosa, belonging to the Anasazi culture, and Three Circle which belongs to the Mogollon culture.

A technological tradition represents the persistence of

a single technique or a group of techniques in the manufacture of pottery that can be arranged in a chronological sequence of fairly long duration. Technological traditions were discussed at different levels of abstraction in order to show a further relationship between stylistic traditions and as a means of considering the ceramic history of Cerro Colorado in a different frame of reference.

All of these approaches to ceramic analysis have contributed to a better understanding of the ceramic history of Cerro Colorado in particular and to that of west central New Mexico in general. There is a strong indication that the style of design concept should prove valuable for reassembling pottery types into broader categories which can be used to advantage in integrative studies, syntheses, classroom instruction, and special studies concerning cultural process and diffusion.

Microfilm \$4.80; Xerox \$16.00, 374 pages.

#### ASTRONOMY

A SEARCH FOR VARIATIONS IN THE LAW OF INTERSTELLAR REDDENING.

(L. C. Card No. Mic 59-3251)

Kenneth Leslie Hallam, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Arthur D. Code

Photometric observations in seven spectral regions between 2950A and 11000A have been made of 54 reddened OB stars and 37 slightly reddened OB comparisons with a red-sensitive photomultiplier. The frequency dependence of the extinction of the light from each of the reddened stars has been determined. Variations in the dependences are found to occur throughout the Galaxy. The greatest differences in the form of reddening occur between regions of bright and dark nebulosity. The region of the Trapezium in Orion is studied in detail.

Microfilm \$2.00; Xerox \$3.00. 42 pages.

#### BACTERIOLOGY

STUDIES ON CYTOPHAGA SUCCINICANS N. SP., A FACULTATIVELY ANAEROBIC, AQUATIC MYXOBACTERIUM.

(L. C. Card No. Mic 59-3310)

Richard Lee Anderson, Ph.D. University of Washington, 1959

Chairman: Dr. Erling J. Ordal

Myxobacteria capable of growing anaerobically at the expense of carbohydrate fermentation were found to be common in certain fish-bearing waters. Three strains of these fresh-water, facultatively anaerobic myxobacteria were selected for further study and were found to have similar properties. They were considered to be members of a new species, which was named Cytophaga succinicans.

C. succinicans can grow anaerobically on a medium containing peptone, yeast extract, beef extract, and glucose only if a substrate amount of CO<sub>2</sub> is provided. Both the amount of growth and the amount of glucose fermented are proportional to the amount of CO<sub>2</sub> available. CO<sub>2</sub> is also required for the fermentation of glucose by resting cell suspensions. In a typical fermentation by a cell suspension, 5 micromoles of glucose yielded 5.9 micromoles of succinate, 3.9 micromoles of acetate, and 2.1 micromoles of formate, with a net uptake of 3.9 micromoles of CO<sub>2</sub>.

By tracer techniques it was found that essentially all of the fixed CO<sub>2</sub> appeared in the carboxyl carbons of succinate. A phosphoenolpyruvate-CO<sub>2</sub>-condensing reaction which is stimulated by guanosine diphosphate was demonstrated in extracts. It was concluded that CO<sub>2</sub> functions in the fermentation by supplying, through condensation with phosphoenolpyruvate, hydrogen acceptors which can be used for the oxidation of reduced diphosphopyridine nucleotide.

Evidence is presented which suggests that C. succinicans can degrade glucose to pyruvate through the Emden-Meyerhoff pathway. The routes of formation of the end products were investigated and were found to involve known pathways.

Microfilm \$2.00; Xerox \$4.60. 90 pages.

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ROLE OF GLUCOSE AND AMINO ACIDS IN THE GROWTH OF BACTERIUM P.A. 3679.

(L. C. Card No. Mic 59-3410)

Harold Cecil Nordan, Ph.D. Oregon State College, 1959

Major Professor: C. M. Gilmour

In spite of the successful control of putrefactive anaerobes in the canning industry, very little fundamental information on growth and related cell metabolism has been reported. Yet it has long been realized that a more complete understanding of heat resistance of spores and mode of spore formation can be attained only when the overall growth and metabolism of the vegetative cell is thoroughly investigated. The study herein reported represents an attempt in this direction. Specific objectives are listed as follows: to develop a suitable procedure for the measurement of anaerobic growth, to evaluate growth media and to investigate role of specific substrates, e.g., glucose and amino acids, in the overall metabolism of the cell. Growth studies were initially carried out in an anaerobic incubator. Difficulties associated with this apparatus in growth studies led to the design of an anaerobic gasflow apparatus which proved very effective for cell growth measurements. A semi-synthetic medium was developed containing glucose and selected amino acids. The stimulatory effect of glucose, yeast extract, pyruvate, acetate and amino acid level was evaluated. Radiorespirometric experiments were carried out to assess the catabolic pathways involved in glucose dissimilation. The procedure used was that of Wang et al. (42, pp. 207-216). CO2 fixation was assessed by exposing the organism to C14 O2 and pyruvate in an apparatus suitable for the growth of an anaerobic organism. This was followed by oxidation of the cells (10, pp. 1225-1226; 21, pp. 1503-1504) and assessment of the  $C^{14}$  as  $C^{14}O_2$ . Amino acid chromatograms were done by a modification of the method of Hausmann (19, pp. 3181-3182). Glucose was observed to markedly stimulate the growth of P. A. 3679 while pyruvate gave no stimulation and acetate appeared to be slightly inhibitory. Yeast extract at a very low concentration was stimulatory to growth in synthetic medium and allowed the use of washed cells as inoculum. It has been shown that certain amino acids are utilized in large concentrations by the test organism. The rediorespirometric pattern of glucose dissimilation indicates that the organism oxidizes glucose by the Embden-Meyerhof-Parnas pathway. Pyruvate and acetate were not decarboxylated in the radiorespirometric experiments. This result while supporting the growth data with pyruvate and acetate is not consistent with the tracer experiments with glucose. The absence of active decarboxylation of pyruvate is thought to be a matter of permeability preventing the pyruvate from entering the cell. It has been demonstrated that the organism does not fix CO2 to any extent under the conditions of this experiment. This may also be limited by the inability of pyruvate to enter the cell. Glucose exerted a sparing action on the cell uptake of certain amino acids while increasing the utilization of others. Certain carbon atoms of glucose have been shown to be incorporated into the cellular amino acids of P. A. 3679. It was concluded that the primary role of glucose in the metabolism of this organism is as an energy source. A secondary role involves the participation of glucose in the biosynthesis of certain amino acids.

Microfilm \$2.00; Xerox \$4.20. 79 pages.

A VIRUS OF OVINE ABORTION. ISOLATION FROM SHEEP IN THE UNITED STATES AND CHARACTERIZATION OF THE AGENT.

(L. C. Card No. Mic 59-3279)

Hazel Dunlap Parker, Ph.D. The University of Wisconsin, 1959

Supervisor: Associate Professor Duard L. Walker

A virus considered to be in the psittacosis-lymphogranuloma venereum group was isolated from sheep in Montana which exhibited symptoms closely resembling those of enzootic abortion of ewes as described by Stamp. This agent exhibited an affinity for yolk sac tissue of embryonating eggs, mouse lungs, and placental tissue of ewes and guinea pigs. Moderate doses produced little or no clinical disease in mice by the intraperitoneal, intracerebral, or intravenous route, but were lethal on intranasal administration. Intraperitoneal inoculation of moderate doses into guinea pigs produced a typical clinical and pathological syndrome which resulted in recovery and resistance to reinfection. Cross immunity between this virus and the Stamp virus was demonstrated in guinea pigs. As its characteristics corresponded closely to those observed in this laboratory or reported by others for the virus of enzootic abortion of ewes, it was identified as a strain of that virus. Until further information is available, however, its relationship to several very similar viruses of the PL group is uncertain.

Microfilm \$2.00; Xerox \$3.00. 51 pages.

COMPARISON OF STABLE AND ABORTIVE TRANSDUCTION IN AN ADENINE-REQUIRING MUTANT OF SALMONELLA TYPHIMURIUM.

(L. C. Card No. Mic 59-3000)

Hassan Rouhandeh, Ph.D. Kansas State University, 1959

Even as early as the 1920s, investigators indicated that bacteria are excellent tools for the study of genetic phenomena. The present studies have been made in the hope that an understanding of the mode of genetic transfer of material from one bacterial cell to another may further result in a similarity being shown between bacteria and higher organisms and the results being equated. The phenomenon of transduction, which is the most recently discovered method of genetic transfer is the basis for the work presented.

Stable transduction has been viewed as a process whereby a piece of bacteriophage-transported material is incorporated into the genome of a recipient bacterium. In contrast to stable transduction in which the transduced

cells develop into normal colonies, is a phenomenon called abortive transduction wherein the cells grow only to minute colonies. The purpose of this study was to characterize the difference between stable and abortive transduction in an adenine-requiring mutant of Salmonella typhimurium. Experiments were undertaken to distinguish between two possibilities: (1) Abortive transduction, in contrast to stable transduction, is a case in which donor genetic material fails to undergo any interaction with recipient genome, that is, the phage merely delivers the genetic material, but the subsequent step of alignment and interaction with recipient genome never materializes; or, (2) for either stable or abortive transduction, donor genetic material must align and interact with recipient genome.

The experiments exhibited the effect of various physical and chemical agents on the ratio and frequencies of abortive and stable transduction. The results indicated that transduction frequency was increased by any one of several procedures, that is, mild ultraviolet irradiation of recipient cells, mild ultraviolet irradiation of transducing phage, treatment of recipient cells with 0.001 M concentration of the chelating agent ethylene diamine tetraacetic acid, treatment of recipient cells with 25 micrograms per ml of chloromycetin, increasing multiplicity of infection, even though non-transducing phage was used to increase this multiplicity, by lowering the temperature of recipient cells or by selection of young cells (four to eight hours old) as compared to 24-hour-old bacteria.

The ratio of abortive to stable colonies held fairly con-

stant at 10:1 in experiments using sensitive recipient cells, regardless of treatment used. However, two exceptions occurred—one when the phage was subjected to ultraviolet irradiation longer than four minutes and one in the case of treatment of the cells with nitrogen mustard—in which the ratios decreased. In experiments using lysogenic recipient cells the ratio of abortive to stable colonies jumped to 20:1, regardless of use of temperate or virulent phage or of treatment. In each case where the frequency of stable transduction was increased, the frequency of abortive transduction was also increased. The interpretation of these results was that, upon increasing the probability of incorporation of the donor piece into the genome of the recipient, this increase was not at the expense of abortive transduction.

Transduction frequencies were unaffected by treatment of recipient cells with any of several chemical mutagenic agents. These included nitrogen mustard, colchicin, manganous chloride, 3-methyl chloroanthrene, 3-methyl dimethyl amine and acriflavine. The ratio of abortives to stables usually remained constant, suggesting that initial events in both stable and abortive transduction were the same. Attempts to interfere with the probability of the success of one resulted in interference with the other.

Thus, it may be seen that results favored the aforementioned second possibility; interaction must take place with the genome of recipient before donor genetic material can become functional, even in the case of abortive transduction.

Microfilm \$2.00; Xerox \$4.60. 87 pages.

#### BIOGRAPHY

#### THE LIFE OF ALICE MARY ROBERTSON

(L. C. Card No. Mic 59-2971)

Joe Powell Spaulding, Ph.D. The University of Oklahoma, 1959

Major Professor: Dr. Edwin C. McReynolds

The purpose of this study is to present an appreciation of Alice Mary Robertson and to point out her many contributions as Indian missionary, educator, business woman, benefactor and congresswoman. These contributions were all the more notable for having been made at a time when women in public life were considered out of place.

The method of approach is chronological. After a chapter of background information which deals with her ancestry, the study moves on from the circumstances of her birth at Tullahassee, Indian Territory, in 1854, to her death at Muskogee, Oklahoma, in 1931. Although the presentation is strictly chronological, each chapter points out the distinct achievements of its particular period.

Chapter two is entitled, "Alice Mary--The Cook." Her assumption of household duties because of the failing health of her mother very early instilled in her a sense of responsibility. Chapter three, "School Girl and Clerk," takes up her life at the age of seventeen when she went away to college, and proceeds to a consideration of her

first job as Clerk in the Indian Office. "Educator, School Supervisor, Postmaster," the title of the next chapter, shows her appointment as Supervisor of Creek Schools in 1900 and her appointment as Postmaster of Muskogee in 1904. From 1913 to 1920 she was a "Farmer, Restaurateur, War Citizen," which is the designation of chapter five. At the advanced age of 66, she was a successful "Candidate for Congress," which chapter six depicts. Her career as congresswoman is portrayed in chapter seven, "Alice Robertson in Congress." Her defeat in 1922 is the story of the eighth chapter -- "The Defeated Candidate." After her term in Congress, she was appointed "Social Welfare Director" of the new Veterans Hospital of Muskogee, Oklahoma, an activity related in chapter nine. The last chapter -- "The Closing Years" -- tells of her dependency on others for support, of her failing health, and of her death. A summary follows in which her contributions to her state are fully delineated.

The materials examined in the pursuance of this investigation were for the most part primary sources. They consisted of her own articles in newspapers and magazines; government documents; and biographical material including press clippings, magazine articles, photos, and interviews. Most of these sources were found in the archives of the Oklahoma Historical Society and the University of Tulsa library. Of particular importance was the complete chronological file of her letters in the University of Tulsa

library. The secondary sources examined were limited to background material on the times in Oklahoma and in the nation.

The study reveals her as a patriotic citizen of varied interests and deep sympathy for unfortunates, especially

Indians who had not enjoyed the advantages of civilization. It portrays her as an extreme conservative in politics, religion, economics and personal habits. It concludes that the memory of a life dedicated to the welfare of others is worth preserving. Microfilm \$2.95; Xerox \$10.20. 227 pages.

#### BIOLOGY - GENETICS

THE RELATION OF THE SERUM PHOSPHATASES TO GROWTH OF GENETICALLY DIFFERENT GROUPS OF BEEF CATTLE.

(L. C. Card No. Mic 59-3398)

Graham Irving Alexander, Ph.D. Oregon State College, 1959

Major Professor: Ralph Bogart

The association of serum alkaline and acid phosphatases and serum inorganic phosphate with various performance criteria have been considered for 46 suckling calves, 52 calves on performance test and 67 adult cows. Of the two breeds involved in the study, the Herefords consisted of three closed lines and the Aberdeen Angus of one closed line of cattlε.

The calves of the Hereford lines had heavier birth weights than that of the Angus calves. No sex or line differences were found in the suckling gain to six months of age. Commencing the performance test period at 500 pounds body weight, the male calves were younger than the females and the calves in the Angus line were younger than those in the Hereford lines. A marked sex difference in rate of gain in all lines was observed, the males making faster and more economical gains than the females.

A steady decline in serum alkaline phosphatase level with age was evident during the suckling period with a corresponding diminution in the variation in the levels. During the performance test period, the serum alkaline phosphatase level did not show any decline with age but sex differences were observed at 700 and 800 pounds body weight. In the adult animals, two-year-old cows had significantly higher levels than the three-year-old cows and there was a significant overall effect of age on serum alkaline phosphatase level.

No sex or line differences were detected in the serum acid phosphatase levels of the calves during the suckling period. During the feed performance test period an overall sex difference was found at 700 pounds body weight. At 800 pounds body weight, the Angus males had higher levels than the Angus females. The level of the male calves increased with age while age had no effect on the level of the female calves during the feed test period. The adult cows did not show any line or age differences in serum acid phosphatase.

The highest average serum inorganic phosphate level was recorded for the suckling calves at three months of age. After this peak, there was a steady decline with age in all animals. During the performance test period, significant differences were recorded between the lines but

there was no influence of sex. The female calves did however show a significant decline in level with age. Also in the adult cows there was a steady decline in serum inorganic phosphate level with age.

During the suckling period there was no relationship between the blood constituents and either birth weight or suckling gain. During the feed test period, a number of correlations were found between the blood constituents and the performance data, the most consistent being that between alkaline phosphatase level and rate of gain. At 700 and 800 pounds body weight, the relationship was found to be associated with sex differences but at 500 pounds body weight, the relationship was real and not associated with sex, age or feed economy.

A prediction equation was developed using sex, age at the commencement of the feed test period, and the serum alkaline phosphatase level at 500 pounds body weight.

Microfilm \$2.00; Xerox \$5.20. 101 pages.

#### DEVELOPMENT OF SEED IN SOLANUM PHUREJA JUZ. ET BUK.

(L. C. Card No. Mic 59-3247)

Vishnu Ramchandra Dnyansagar, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Delmer C. Cooper

Detailed analyses of the course of development of the seed and its constituent parts are sparse for any species of the genus Solanum. They are almost negligible for any member of the economically important Section Tuberarium. Ontogeny of the endosperm, embryo and testa of S. phureja was carefully checked during the course of the present study.

The mature ovules of <u>S. phureja</u> conform to either the anatropous or campylotropous types. The megagametophyte, during the course of its development, completely digests the nucellus and at maturity is directly associated with the endothelium or innermost layer of the single massive integument. The megagametophyte is a seven-celled structure consisting of 3-celled egg apparatus, a binucleate endosperm mother cell and three persistent antipodals.

The mature pollen grains are either bi-celled or trinucleate. Since both types are produced within anthers of the same flower, the number of nuclei in the pollen grain is not to be considered a character of any taxonomic value. Further, the type of pollen grain cannot be correlated with self-incompatibility. Double fertilization takes place between 24 and 72 hours after pollination. The endosperm mother cell divides before the zygote. Endosperm formation follows the Cellular type. A distinct peripheral layer of the endosperm is organized as an aleurone layer, the cells of which are densely cytoplasmic and at maturity are devoid of starch. It performs the function of absorption of nutrients. The endosperm forms a chalazal haustorium which absorbs nutrients from cells in direct association with the vascular strand. It beings to be digested by the developing embryo from the latter's heart-shaped stage onwards and in the mature seed the endosperm occupies about half the space as compared with that occupied by the embryo. It functions as a supplementary storage tissue.

The embryo development follows the Solanad Type, Nicotiana Viriation of Johansen or the Megarchtype V of the Series C of the First Period of Souèges. Starch grains are present in the suspensor. The mature embryo has an

inverted "U" shape.

Linear growth relations between the developing seed and embryo during 20 days indicate that the grand periods of growth of the seed are between 7 - 12 and 16 - 17 days and of the embryo are between 7 - 10 and 19 - 20 days after pollination. The ratio of the rate of linear development of the embryo and the seed is approximately 3:1.

The expanding integument of the ovule differentiates and ultimately forms the testa of the mature seed. During the course of the development of the testa, the cells of the outermost layer of the integument become thick-walled, the the middle layers are digested, and the endothelium becomes very much reduced. The mature testa is thus composed of only the outer thick-walled and the inner thinwalled epidermis with the disorganized tissue between them.

Approximately half of the ovules abort. In such cases, the endothelial cells proliferate producing large outgrowths which extend into the cavity occupied by the megagametophyte in the unfertilized ovules or that occupied by the endosperm which was developing for sometime in the fertilized ovules. Microfilm \$2.00; Xerox \$3.80. 69 pages.

THE MICROSCOPIC ENZYME CYTOCHEMISTRY OF CARBOXYLIC ESTERASES IN SEVERAL SPECIES OF FRESH WATER AMOEBAE. (VOLUMES I AND II).

(L. C. Card No. Mic 59-1068)

Hyman Guthwin, Ph.D. New York University, 1956

Adviser: Professor M. J. Kopac

The five substrates -- beta-naphthyl acetate, naphthol AS acetate, Tween 60, Tween 80 and myristoyl choline -- and their laurate homologs were studied. The amoebae were Amoeba dubia, Amoeba proteus, Pelomyxa carolinensis and Pelomyxa illinoisensis. Food organisms and debris were concomitantly studied. Primary fixation in acetone followed by drying on cover slips, rehydration with lightly hydrated acetone, drying to assure affixture, secondary fixation in formalin and washing prior to incubation produced the most satisfactory reactions.

Ten-grade color comparators with intensities arith-

metically graded, but geometrically related provided objectivity, reproducibility, discrimination and information on non-specific coloration levels, attributable to endogenous cation, exogenous cation and the effects on these of inactivation procedures and deficiency media. Heat or phenol inactivation levels integrated most non-specific levels. Trapping of the primary reaction product with Tween 60 and myristoyl choline in the absence of cation, but not with Tween 80, took place, depending on solubility and melting point relative to the incubation temperature. Alpha-naphthyl diazonium naphthylene 1, 5-disulphonate provided the best differentiation between specific and non-specific hues.

Decidedly inverse relationships between Amoeba dubia and Amoeba proteus activities towards beta-naphthyl Acetate and naphthol A S acetate suggested the duality of the corresponding enzyme. Unusually high activity towards beta-naphthyl acetate and unusually low activity towards other substrates in Amoeba proteus suggested a compensatory mechanism. In all species activity towards the oleate ester was lowest.

Biochemically three cardinal types of carboxylic esterases were suggested by the effects of arsenilate, eserine, fluoride, quinine, taurocholate, cation, substrate concentration and poor reactions with the homologs of intermediate chain length. pH-activity curves with Tween 60 and also with Tween 80 and the effect on them of taurocholate concentrations were similar to those reported for lipase.

On the basis of the Gomori histochemical classification, activity in the food vacuoles of Amoeba dubia, Pelomyxa carolinensis and Pelomyxa illinoisensis was predominantly of the lipase-esterase-cholinesterase type. In the food vacuoles of Amoeba proteus, activity was of the alphaesterase type, with some activity of the lipase-esterase-

cholinesterase type.

In the cytoplasm, activity giving rise to fine deposition in Amoeba dubia and in Pelomyxa illinoisensis was at a level intermediate between the lipase-esterase-cholinesterase type and the esterase-cholinesterase type. In Amoeba proteus, this activity was predominantly of the esterase type with some at the level of the lipase-esterase-cholinesterase type. In Pelomyxa carolinensis, activity was predominantly of the esterase-cholinesterase type with some at the level of the lipase-esterase-cholinesterase type with some at the level of the lipase-esterase-cholinesterase type.

In the cytoplasm, activity giving rise to the coarse deposition in Amoeba dubia, especially that giving rise to eserine-sensitive surface encrustation, was of the cholinesterase type, with some activity within the cytoplasm at the level of the lipase-cholinesterase type. In Amoebe proteus, this activity was on the level of "sub-A" type, for which no examples are cited in the Gomori classification, and was discretely dispersed. In Pelomyxa carolinensis and illinoisensis, this activity was predominantly of the lipase type with a cholinesterase component.

The reactions in the amoebae could not be ascribed to reactions observed in food organisms and in the debris. Debris activity towards taurocholate, in the absence of substrate, resulted in a calcium precipitable product. This was not observed in the amoebae.

No activity was detected in the nuclei of any of the species.

The metabolic significance of entities of the type dealt with by the enzymes in the present investigation was presented in a metabolic map.

Microfilm \$6.65; Xerox \$23.00. 521 pages.

## SELECTION FOR BODY WEIGHT IN SYNTHETIC MONOPAROUS POPULATIONS OF MICE.

(L. C. Card No. Mic 59-3408)

Robert William Mason, Ph.D. Oregon State College, 1959

Major Professor: Ralph Bogart

A selection experiment was conducted with synthetic monoparous populations of mice incorporating selection for large and for small 45-day body weights. Superimposed upon the selection for large and for small body weights was (1) selection for males on their own merit or (2) selection of males solely on their mothers' merit. In all of the treatments the females were selected on their own merit. An unselected control was included. Thus there were five treatments designated as: I, large-individual; II, small-individual; III, large-mother; IV, small-mother; and V, control. The breeding groups consisted of 20 females. The breeding groups of the first 4 treatments also contained 5 males, whereas there were 20 males in the control breeding groups. The litters were adjusted to four in number at birth and one mouse, randomly selected, was identified by toe marking. This mouse was the only one which was used to represent the litter after weaning, thus simulating a monoparous situation, i.e., a situation in which the females of the population produce only one or zero offspring per "mating year". In this experiment a "mating year" consisted of 81 days to correspond to a calendar year in a beef cattle population. No characteristic other than 45-day body weight was considered in selection and possible environmental effects were disregarded. Selection was practiced by both methods for large and for small 45-day body weights for the equivalent of six years in a beef cattle operation.

With 99 per cent confidence, heritability of 45-day body weights expressed as the regression coefficient of off-spring on mid-parent was, initially, 0.39±0.15. The corresponding heritability estimates (pooled for the six years of selection) were: 0.55 for individual selection of males for large 45-day body weights; -0.17 for individual selection of males for small 45-day body weights; 0.43 for mother selection of males for large 45-day body weights; and, 0.44 for mother selection of males for small 45-day

body weights.

Expected maximum selection differentials, under ideal conditions, were estimated and reasonably approximated the realized selection differentials. However, slightly greater than expected selection differentials were attained in mother selection.

The responses to selection indicated by the observed differences in 45-day body weight between offspring born from large and from small selected parents in individual selection, and also in mother selection, were reasonably close to the differences expected on the basis of the estimated maximum selection differentials and a heritability of 40 per cent.

Realized heritability, based on two-way standard selection differentials and responses, averaged 0.24 in individual

selection and 0.40 in mother selection.

The expected effectiveness of mother selection, relative to individual selection under ideal conditions, was estimated to average 0.48 over the six mating years of selection. The observed effectiveness in terms of standard

selection differentials averaged 0.69, whereas the observed effectiveness in terms of responses averaged 0.82.

Although the results of the present investigation are only indicative, it is proposed that genetic progress in any trait of sufficiently high heritability could be made in a closed commercial herd of beef cattle if bull calves were selected from the most outstanding young cows, and for greater assurance of success, it is proposed that each bull should be used for only one or two years.

Microfilm \$2.00; Xerox \$4.20. 77 pages.

#### INTERRELATIONSHIP BETWEEN COLICIN SENSITIVITY AND PHAGE RESISTANCE.

(L. C. Card No. Mic 59-3122)

Frank Hiroshi Mukai, Ph.D. Columbia University, 1959

When cultures of Escherichia coli, strain 15, are irradiated with ultraviolet light, the bacteria are induced to form a bactericidal material, colicin-15. Colicin-15 is released by the lysis of bacteria which undergo a residual growth without division. The only strains of bacteria sensitive to the action of colicin-15 were derivatives of strain 15. Three colicin-resistant strains were obtained, all of which became simultaneously sensitive to every T-phage, while the colicin-sensitive parental strains were lysed only by T2. By stepwise reversal of the phage sensitivity pattern, it was possible to revert colicin-resistant mutants to colicin sensitivity again. Only certain mutations conferring resistance in concert to phages T1, T3, T4, T5, and T7 resulted in colicin sensitivity. A model which will account for these phenomena is presented.

Microfilm \$2.00; Xerox \$3.00. 34 pages.

#### STUDIES ON PHOSPHATASES AND LIPASES IN CERTAIN TURBELLARIA.

(L. C. Card No. Mic 59-3561)

Paul James Osborne, Ph.D. The University of Florida, 1955

The Gomori techniques for histochemical tests were used to demonstrate the presence and loci of alkaline phosphatase, acid phosphatase, and lipase activity in five species representing three orders of Turbellaria. These studies were supplemented by tests for fatty substances which were made with the McManus technique.

Alkaline phosphatase activity of generally high intensity was widely distributed in all five of the species studies (Dugesia tigrina, Curtisia foremani, Bipalium kewense, Geocentrophora applanata, and Stenostomum tenuicaudatum). The presence of nutritive material increased the activity. Acid phosphatase activity was found only in the first three (triclads), and then mainly during periods of starvation, when alkaline phosphatase was less evident. This suggests that acid phosphatase probably has functions similar to those of alkaline phosphatase, but operates in a lower (acid) pH medium, possibly during periods of autolysis.

Only <u>Dugesia tigrina</u> and <u>Curtisia foremani</u>, both aquatic triclads, and <u>Geocentrophora applanata</u>, an alloeocoele, showed evidence of lipase activity. It was limited to the gut, and occurred only during the first five days after feeding. This roughly coincided with the locus and time of the maximum intensity for alkaline phosphatase activity. However, the phosphatase appeared to be activated in a wave like fashion, beginning in the gut and moving out with the nutrients through the gut wall and on through the parenchyma.

It is interesting that the rhabdocoele <u>Stenostomum</u> tenuicaudatum, the smallest and least complex of the worms studied, gave negative results for acid phosphatase, lipase, and fats.

Fatty substances were evident in all other forms studied. They were not limited to areas of lipase activity, but occurred also in structures exhibiting only phosphatase activity.

Special roles on the part of the phosphatases in the activities of regeneration, digestion, transporting, secretion, excretion, and energy metabolism are suggested. These are in substantial agreement with the findings of various investigators who worked with other organisms.

The specific differences in the activity and distribution of the enzymes and fatty substances suggest a possible evolutionary sequence for several enzyme systems. Also the significance of this work as another means of determining the physiology of these flatworms is pointed out.

Microfilm \$2.00; Xerox \$4.60. 89 pages.

#### THE LOCOMOTIVE PERFORMANCE OF SALMONOIDS DURING UPSTREAM MIGRATION.

(L. C. Card No. Mic 59-3341)

Gerald John Paulik, Ph.D. University of Washington, 1959

Chairman: Allan C. DeLacy

Two basic types of testing devices and associated techniques for measuring the swimming ability of large active fish under controlled conditions were developed. One device was an annular tank, 11 feet in diameter, which could be rotated to generate any water velocity from zero to 30 f.p.s. in a circular test channel. The other was a 25-foot long straight flume mounted on a 40-foot barge for use in the field. A propeller pump supplied currents up to 12 f.p.s. in the flume. A comparative evaluation of the two devices, based on the behavior characteristics and swimming performances of adult salmonoids, showed that the straight flume measured a fish's absolute swimming ability more accurately and precisely than the annular tank.

Swimming abilities of adult blueback salmon at various locations along their migration route in the Columbia River system were determined during 1956 and 1957. Swimming performance tests were conducted in the annular tank using blueback transported to Seattle during 1956. In 1957, swimming tests were conducted in the straight flume at dam sites in the Columbia River. The 1956 experiments showed that the blueback's capacity to swim at 4.3 f.p.s. was drastically reduced after they had passed

through Lake Wenatchee, but the results were inconclusive with regard to the swimming ability of the blueback in the main Columbia River. Blueback subjected to daily swimming tests during 1956 did not live as long as control fish which were not tested.

During 1957, 168 blueback were tested over a seven-day period at McNary Dam, 253 over a thirteen-day period at Rock Island Dam, and 48 fish from Tumwater Dam were tested at Rock Island. Mean swimming times at 9.4 f.p.s. were 64.9 seconds at McNary, 62.4 at Rock Island, and 59.2 at Tumwater; and at 6.6 f.p.s. were 196.4 seconds at McNary, 173.8 at Rock Island, and 153.7 at Tumwater. The decrease at 6.6 f.p.s. was statistically significant. The blueback's swimming ability at 5.3 f.p.s. decreased significantly between Rock Island and Tumwater.

Differences in swimming ability at low water velocities were also found between early and late-run silver salmon taken from a short stream in the Puget Sound watershed.

It was postulated, from the results of these experiments, that a definite decrement in the swimming ability of a salmon occurs during upstream migration. The decrement is most pronounced at lower swimming speeds.

All of the salmon used in 1957 were tested on each of two successive days and tagged and released after the second test. The percentage of blueback recovered from Rock Island was much higher than from McNary. Survival times for blueback taken from the lower river during 1956 were shorter than for blueback from the upper river. These findings indicate that the same exertion and delay may be more harmful to the salmon at one location in the river than at another. This conclusion is supported by a decrease in swimming times observed on the second-test day at McNary but not at Rock Island.

Recovery percentages of blueback tagged after testing at Rock Island were about one-half as high as those for blueback which had not been tested, suggesting that the test-fish experienced a high delayed mortality.

The lengths of time that silver salmon, steelhead, and blueback were able to swim before they became exhausted at water velocities from 4 to 10 f.p.s. were measured. These observations may be used to determine water velocity conditions that would not interfere with the passage of migrant salmon.

Microfilm \$3.05; Xerox \$10.40. 233 pages.

## THE INHERITANCE OF IODINE VALUE IN RICE AND ITS ASSOCIATION WITH OTHER CHARACTERS.

(L. C. Card No. Mic 59-3083)

Ramaswamy Seetharaman, Ph.D. Louisiana State University, 1959

Supervisor: Professor M. T. Henderson

Inheritance of amylose content in rice interms of iodine value was studied in the F<sub>1</sub>, F<sub>2</sub> and F<sub>3</sub> generations of a cross between a low iodine variety, Texas Patna and a high iodine variety, Toro. The lower the iodine value, the higher is the amylose content. The materials were grown at the Rice Experiment Station, Crowley, Louisiana and iodine value determinations were made at the Rice-Pasture Experiment Station, Beaumont, Texas, by a method involving use of a starch-iodine blue test.

The mean iodine values of the parents in 1957 were 15.6 for Texas Patna and 56.3 for Toro. The mean of Fi plants was 22.8, a value close to the low iodine parent and indicating partial dominance for low iodine. A mean of 28.5 was obtained for 470 F2 plants, which also indicates that low iodine value was partially dominant in this cross. Although the frequency distribution curve for the 470 F2 plants was continuous, it was distinctly bimodal with a large group of low iodine plants and a smaller group of high iodine plants. An approximate 3:1 ratio was obtained in F<sub>2</sub> between low iodine plants like the Texas Patna and F1 compared to high iodine plants that resembled Toro. This evidence suggested that the parents differed by one pair of genes. However, the occurrence of plants in iodine value classes intermediate between the F1 and Toro provided evidence for the presence of minor genes which had a modifying effect on the major pair. Transgressive segregation occurred only for high iodine value.

In  $F_3$ , it was possible to group the lines into three general classes. Lines included in the first and the third group were relatively homozygous for low and high iodine value, respectively. Lines belonging to the second group segregated for iodine value and were heterozygous. This tended to confirm the conclusion that the parents differed by one major pair of genes. However, differences were apparent between lines included in any one group and these differences were explained as being due to the influence of the minor genes. All evidence from  $F_2$  and  $F_3$  therefore indicated that the parents differed by one pair of major genes and several modifiers.

A heritability value of 98 per cent was obtained from the regression of F<sub>3</sub> means on F<sub>2</sub> plant values, indicating that selection for iodine value on an individual plant basis would be highly effective.

Significant correlation coefficients of -.44 and -.59 were obtained in F<sub>2</sub> and F<sub>3</sub>, respectively, for the association between iodine value and data of heading, indicating a moderately strong relationship of some importance. However, plants or lines with low or moderately low iodine values varied widely in maturity with no association, whereas plants or lines with moderately high or high iodine values showed a strong tendency to be early in maturity. The correlation was therefore suggested to be due mainly to the strong tendency for the plants with high iodine values to be early in maturity. The value for their genetic correlation was -.49.

A correlation coefficient of .41 in  $F_2$  indicated an association of moderate strength between iodine value and apiculus colour. It is probable that one or more of the genes for both traits are linked. The correlation coefficient was much lower in  $F_3$ .

Low correlation coefficients of -.13 and -.02 were obtained in  $F_2$  and  $F_3$  generations, respectively, between iodine value and hull colour.

Microfilm \$2.00; Xerox \$4.20. 78 pages.

## EFFECTIVENESS OF SELECTION METHODS FOR YIELD IN SOYBEAN CROSSES.

(L. C. Card No. Mic 59-3394)

Robert Lee Voigt, Ph.D. Iowa State College, 1959

Supervisor: C. R. Weber

The objectives of this study were to evaluate a method of early generation testing and concurrent phenotypic selection for seed yield with the standard bulk and pedigree methods of breeding, to apply these three selection methods to five soybean crosses to test for interactions of methods with genetic populations, and to obtain superior high yielding lines suitable in maturity, height, and lodging.

Seed of each of 75  $F_2$  plants per cross was divided so that each of the three selection procedures used subsequently was operating on the same genetic germ plasm base. In all three procedures maturity of selections were made to that of Hawkeye check in all generations.

The bulk mathod consisted of compositing two seeds from each of the 75 F<sub>2</sub> plants per cross. The composite was grown through the F<sub>3</sub> and F<sub>4</sub> generations. Twenty desirable plants per cross were selected from the spaced F<sub>4</sub> bulked generation for entry in the F<sub>5</sub> replicated test. The remaining seed of the 75 F<sub>2</sub> plants was grown in an F<sub>3</sub> row from which three plants were selected for the pedigree method and three for an F4 early generation test. The pedigree selections were each part drilled and part space-planted in the F4. Twenty spaced F4 plants were selected per cross on the basis of phenotypically selected drilled rows and entered in the F<sub>5</sub> replicated test. No two selections traced to the same F<sub>2</sub> plant. Single plants from the highest yielding 20 lines per cross in the F<sub>4</sub> early generation test were entered in F5 replicated tests to compare with bulk and pedigree selections.

The early generation test produced lines significantly higher in yield in the F<sub>5</sub> test compared to previously non-yield tested lines by bulk and pedigree methods. Early generation testing produced a greater number of lines significantly above the cross mean yields and fewer significantly below than bulk or pedigree methods. A greater number of lines by the early generation testing method exceeded the Hawkeye mean yield than by the bulk or pedigree methods. There was no significant yield interaction for selection methods x crosses.

Maturity differences among selection methods were inconsequential in magnitude. Lines by early generation testing were shortest and lodged least compared with those selected by pedigree and bulk methods. The pedigree method produced lines more suitable in maturity, height, and lodging than the bulk method but equal in yield.

Superior high yielding lines were obtained with suitable maturity, height, and lodging resistance. Further evaluation of the better strains may prove one or more worthy of varietal release.

Microfilm \$2.00; Xerox \$3.00. 36 pages.

STUDIES ON THE EFFECTS OF
2, 4-DICHLOROPHENOXYACETIC ACID ON
BRASSICA KABER D.C., HIBISCUS ESCULENTUS L.,
AND HELIANTHUS ANNUUS L.

(L. C. Card No. Mic 59-2989)

Buddha Appalanaidu, Ph.D. Kansas State University, 1959

Since the discovery that 2, 4-dichlorophenoxyacetic acid killed certain broad-leaved plants on application, extensive studies had been conducted to determine the dosages required to obtain maximum kill on weeks. However, little research has been done on the formative influence of this herbicide on vegetative and floral parts of plants; hence the present investigation was undertaken to study the morphological and histological modifications induced by this chemical on the three broad-leaved dicotyledonous species, Brassica kaber, Hibiscus esculentus, and Helianthus annuus.

The plants were grown in six-inch pots using a suitable loam and sand mixture. When they had attained a height of nine to ten inches, they were treated with 2, 4-D at varying concentrations (5,000, 2,500, 500, 250 and 100 ppm) using

two methods, spraying and injection.

Hibiscus and Helianthus exhibited early responses to all concentrations, as leaf epinasty, twisting and bending of petioles and stems and stem splittings. In Brassica responses like epinasty of leaves and stem bendings and splittings were less pronounced. At higher dosages (5,000 and 2,500 ppm) this species responded quickly but very slowly at the other concentrations.

The axillary buds were inhibited in all the three species when the herbicide was injected into the decapitated stems; thus indicating that the chemical had exercised apical

dominence.

Hibiscus and Helianthus continued to grow following sprayings with concentration of 100 ppm and produced several malformed leaves and flowers whereas this concentration was lethal to Brassica. The former two species exhibited various kinds of malformed leaves which became dwarfed and veiny, pouch and brush shaped. In Hibiscus there was a gradation in the degree of injury, i.e., the oldest leaves were less severely affected and this severity then increased as the growth continued but later decreased; therefore normal type of leaves were seen towards the top of treated plants.

Formative changes were more pronounced in Hibiscus flowers than those of Helianthus. In Hibiscus the epicalyx became tubular, corolla was fused, the androecium was reduced, and the number of stigmas increased in some flowers but decreased in others. Similarly the bracts of Helianthus inflorescence had undergone changes both in size and shape. The number of stamens increased in disk florets and the number of stigmas increased in certain flowers. There was a change in the color of bracts, corolla

and stigmas.

Histological changes in the stems of Hibiscus and

Helianthus followed the same pattern. Roots developed from proliferations of the cambium, and from ray and phloem parenchyma. Root development was observed in the pith region of Hibiscus but not in Helianthus. Replacement tissue was well developed in the Hibiscus leaf but only partially in that of Helianthus. In the latter species, roots, unorganized root-like structures, and masses of meristematic cells were differentiated in the inflorescence.

Brassica behaved peculiarly in organizing finger shaped processes from the cambium and parenchyma cells of ray, phloem and cortex. The reason for this type of behavior is unknown. Microfilm \$2.85; Xerox \$9.80. 219 pages.

## MORPHOLOGY AND ANATOMY OF PHORMIUM TENAX FORSTER.

(L. C. Card No. Mic 59-3399)

Sukhum Assavesna, Ph.D. Oregon State College, 1959

Major Professor: Frank H. Smith

Phormium tenax Forster is a genus of the Agaveceae. The materials were collected from the field in a well established experimental planting of the U.S.D.A. near Goldbeach, Oregon. This study is concerned with the origin, development and structure of the vegetative parts of the plant and the development of the megagametophyte.

The origin of the adventitious root involves a group of cells in the vicinity of the meristematic ring of the stem from which the embryonic steles arise, the endodermis of the stem from which the initials of the cortex originate, and a few cortical cells adjacent to the endodermis from

which the root-cap initials are produced.

There are three groups of initials in the root apex which give rise to the central cylinder, the cortex and epidermis, and the root-cap. The columella is derived by transverse cell divisions while the peripheral part of the root-cap is derived from the calyptrogen initials by tangential cell divisions.

The root has an exarch, radial protostele with 5 to 25 protoxylem ridges. The metaxylem initials are distinguishable about 50 microns back from the apical initials. The protoxylem initials are distinguishable at about 480 microns, but they mature earlier than the metaxylem. The protophloem mother cells become evident at about 180 microns and the sieve tube elements mature about 130 microns above the initial appearance of the protophloem mother cells. Though the early differentiation of xylem precedes phloem differentiation, the protophloem sieve tubes are the first vascular elements to reach maturity.

Lateral roots arise in the pericycle opposite the protoxylem ridges. The endodermis and cortex play no part in the production of lateral roots as they do in the formation of adventitious roots.

The vegetative stem apex is differentiated into two

distinct zones, a two-layered tunica and a corpus. The corpus consists of three zones, the corpus initials at the summit, a rib meristem and a flank meristem. The corpus initials constitute a group of mother cells which contribute to the rib and flank meristems.

The young shoot has a primary thickening meristem between the central cylinder and the cortex. As the stem gets older the vascular network is formed at the periphery of the central cylinder. The leaf traces leave the central cylinder through gaps in the vascular network that resemble leaf gaps. Anastomoses of the traces are abundant, especially near the center of the central cylinder. Root traces connect only to the external surface of the vascular network. Older parts of the stem have a lignified endodermis which is continuous with the endodermis of the adventitious root.

The initiation of a leaf primordium involves periclinal divisions in the outer corpus and subsequent anticlinal divisions in the tunica. The early growth of the primordium is due to division of the ground parenchyma cells and later by the activity of a subapical cell. Further growth and differentiation are largely the result of the activity of an intercalary meristem at the base of the leaf. The thickened outer walls of the epidermal cells of the mature blade are heavily cutinized and also covered with a heavy cuticle. Fiber cells are always associated with the larger vascular bundles and form a band extending from the upper hypodermis to the lower epidermis of the leaf. The fibers are cylindrical in shape with the ends tapering gradually to a point. They vary in length from 0.48 to 1.25 cm. and in diameter from 7 to 22 microns.

The megaspore mother cell of P. tenax is formed directly from the single hypodermal archesporial cell. The megagametophyte development follows the 'Polygonum' type of embryo sac.

Microfilm \$2.00; Xerox \$4.40. 83 pages.

STUDIES ON THE EFFECT OF INDOLEACETIC ACID ON CULTURED TOBACCO PARENCHYMA CELLS.

(L. C. Card No. Mic 59-3172)

Walter Herr Bryan, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Eldon H. Newcomb

Cultured pith tissue excised from stems of Wisconsin No. 38 tobacco has been used to study the cell enlargement induced by the plant growth hormone, indole-3-acetic acid (auxin).

The hormone stimulates increases in both total dry weight and in dry weight of wall material isolated from homogenates of cultured tissue. It also produces increases in the pectic, holocellulose, and lignin fractions. Volume of the isolated wall material is increased and the color of this fraction characteristically becomes yellow in response to the presence of the growth hormone. Liquid from the surfaces of enlarging pith discs contains reducing sugars in a higher concentration than that which exists in the medium directly beneath the tissue.

While the activities of invertase and peroxidase in tissue on auxin rise above the levels found in freshly excised tissue, they increase less than on the control medium. The peroxidase activity of the pith cells appears to be distributed between the wall and cytoplasmic fractions, with approximately 30% of the total activity remaining with the wall fragments.

Dissociation of several responses of cultured pith to auxin has been achieved by osmotic means, using mannitol to adjust the osmotic concentration of the culture medium. Loss of approximately fifteen per cent of the water from the tissue causes loss of the cell enlargement response and of the increase in volume of the wall material. Color of the wall material becomes gray. This treatment does not prevent a stimulation of ascorbic oxidase activity, of endogenous respiration, and of the deposition of pectic substances by the hormone.

Diphenylamine at a concentration of 2 X 10<sup>-4</sup> M in the culture medium inhibits respiration and prevents the cell enlargement induced by auxin.

Inclusion of the highly active cell division factor, 6-furfurylamino purine (kinetin), does not result in the cell separation which occurs in tissue cultured on a medium containing only auxin. However, the rise in fresh weight observed on auxin alone is not diminished. Kinetin brings about little change in the volume or color of wall material or in the content of pectic substances observed for auxin alone. The effects of auxin on the activities of peroxidase, pectin methylesterase, and ascorbic acid oxidase, and on endogenous respiration are accentuated by kinetin.

Galactose-1-phosphate and galacturonic acid-1-phosphate have been synthesized chemically and tested as substrates for the biosynthesis of pectic substances. Wall fragments prepared from several plant species and incubated with galactose-1-phosphate and uridine triphosphate catalyze the formation of a substance which appears to be uridine diphosphate galactose. This reaction is believed to be an early step in the production of galactans and polyuronides. Microfilm \$2.00; Xerox \$6.80. 143 pages.

### THE PHYSIOLOGY OF STRAWBERRY SEED GERMINATION

(L. C. Card No. Mic 59-2993)

Theophilus Chellappa, Ph.D. Kansas State University, 1959

This study was an attempt to determine and identify some of the factors which are responsible for the delayed and incomplete germination of strawberry seeds and to evolve methods for hastening germination. The inconsistency in the rate of germination has caused difficulties in breeding work and efficient handling of the seedlings.

Seeds of Blakemore, Premier and Armore varieties extracted with the Waring blender were used. Seeds stored for eight to twelve months at 6°C and germinated on white Kimpak pads were found to be satisfactory.

Photomicrographs of the longitudinal and cross sections of the strawberry seed (fruit) which is an achene, was prepared and studied. The embryo consisted of a well differentiated plumule, hypocotyl and radicle and relatively large cotyledons. The embryo was enclosed by integuments (seed coat) lined on the inside with a single layer of storage tissue which appeared to be the remnant of endosperm. The

cells of the integuments are filled with dark brown material which seemed to be the layer that offered resistance to the entry of external solutions or gases into the seed. The seed is enclosed by a pericarp (achene wall) composed of several layers of closely packed stone-cells. The pericarp is fused with the integuments only at the base and hence, is not a factor in the dormancy of this seed.

The berries of Blakemore, Premier and Armore are of different shapes. Significant differences in the rate of germination of the seeds collected from different portions of the berry namely, basal, median and distal have been related to the location or position of the seed on the berry. Seeds collected from the portion of the berry which had the largest development as measured by its width gave the highest germination. The width of the distal portion of the berries of each of these varieties was the smallest. The seeds from the distal portions of each of these three varieties gave the lowest percentage of germination. The age of the seed does not appear to alter this situation.

The natural development of the berry according to Nitsch is governed by the auxin concentration in the achene and by the number of developed achenes on the berry. Hence, the shapes of these three varieties may be said to be the result of the varying concentrations in the achenes and the density of achene distribution. This suggests that the rate of germination of strawberry seeds is influenced by their location on the berry which may be due to the differences in the auxin content in the achenes as well as the density of achene distribution in each of the three portions of the berry - the basal, the median and the distal.

The dormancy of strawberry seeds may be partially broken by the application of 0.25 mg of "Gibrel" (a potassium salt of gibberellic acid) in the case of the varieties Blakemore and Premier and 0.10 mg of Gibrel for seeds of Armore variety immediately after sowing under the conditions of these studies.

Seeds of all the three varieties held at alternate temperatures of 30°C for 6 hours during the day and 20°C for 18 hours during the night gave significantly higher percentage of germination than those held at constant temperature of 25°C. The effect of interaction between temperature and the rate of Gibrel application was significant in the germination of seeds of only the Blakemore variety.

Mechanical scarification of seeds of the strawberry variety Blakemore by filing alone did not significantly increase their percentage of germination but the addition of 0.10 mg and 0.25 mg of Gibrel increased the percentages of germination to make them significant over the untreated seeds which served as control. The highest germination of 69.7 per cent at the end of 28 days was obtained with seeds of Blakemore variety scarified with sulfuric acid for 20 minutes and germinated at alternate temperatures immediately after treatment with 0.25 mg of Gibrel. The rotating action of the knife blades of the Waring blender may also have caused some scarification effects on the seed.

Microfilm \$2.00; Xerox \$3.60. 62 pages.

THE RELATION OF FUSARIUM SPECIES TO WILTS AND ROOT ROTS OF RED CLOVER.

(L. C. Card No. Mic 59-3178)

Chien Chen Chi, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Earle W. Hanson

This study was made to obtain needed information concerning the relation of <u>Fusarium oxysporum</u>, <u>F. roseum</u>, and <u>F. solani</u> to wilts and root rots of red clover. Major consideration was given to the factors affecting the biology and physiology of these pathogens, the effects of environmental factors on host and disease development, the relative pathogenicity and host range of different isolates, the method of penetration, spread, and colonization of the host by the pathogens, the nature and cause of the silting and a few other related aspects.

Optimum temperature for growth of all isolates was 28°C. Isolates differed in their responses to temperatures above or below 28°. Only <u>F</u>. solani grew at 36° and only <u>F</u>. roseum produced any measurable growth at 4°. Optimum temperature for germination of conidia was also 28°.

Greatest amounts of fungus growth and highest percentages of germination occurred on media having a pH of 4.6-6.0, the optimum being pH 5.0. Potato-sucrose medium was the best all-purpose substrate tested; wheat bran was probably second best. Of 8 compounds studied as carbon sources, dextrose was best, followed by maltose and sucrose. Organic nitrogen was the best source of nitrogen and nitrate nitrogen was superior to ammonium nitrogen. All isolates grew and germinated relatively well in both low and high concentrations of Hoagland solution.

There were wide differences in relative pathogenicity between isolates of each of the 3 species of Fusarium studied; on the average F. solani was most pathogenic followed by F. oxysporum, and F. roseum in that order. Red clover varieties differed in susceptibility. Lakeland and Dollard were most susceptible, Kenland was most resistant, and Chesapeake and Pennscott were intermediate. Nineteen species in 4 families of plants were tested for susceptibility to red clover isolates; only legumes became infected. Also isolates of F. oxysporum from cabbage, tomato, and pea did not infect red clover.

Optimum temperature for disease development was about 28°C, minimum about 12°, and the maximum about 32°. Red clover grew best at 24°. Low soil moisture increased disease development and very high soil moisture decreased it, but disease developed well over a wide moisture range including the moisture range optimum for the host. Plants grew best at pH 5.0-7.0; disease severity was also greatest in this range.

Both top and root growth of red clover plants decreased and disease increased when N, P, or K was omitted from an otherwise balanced nutrient solution. Greatest effects were observed when N was omitted. In a study of the effects of various salt concentrations of balanced nutrient solutions, disease severity was lowest at concentrations optimum for the host and greatest at concentrations below optimum. Histological studies showed that tissues from plants fed low concentrations were more succulent and less mature than those from plants fed higher concentrations.

Both antagonistic and synergistic effects were observed

when soil was infested with various combinations of species of Fusarium.

The isolates studied produced certain thermolabile metabolites and probably also a thermostable toxin. When these were taken up through cut ends of red clover stems, vascular browning followed by plugging and wilting occurred. The wilting developed more rapidly when the plants were kept in light than in darkness. Dilutions of the filtrates up to 1:4 induced rapid and severe wilting; dilutions above 1:8 produced less symptoms. Filtrates were not specific as to suscepts affected.

The pathogens entered the host through wounds or penetrated directly through the epidermal cells of root tips and root hairs. After gaining entrance they spread inwardly through the parenchymatous tissue towards the xylem and entered the xylem vessels. Subsequent growth was mainly in the tracheae but in late stages other cells were also invaded.

Microfilm \$2.00; Xerox \$6.80. 141 pages.

# THE CYTOLOGY AND GENETICS OF HELMINTHOSPORIUM TURCICUM AND ITS ASCIGEROUS STAGE, TRICHOMETASPHAERIA TURCICA.

(L. C. Card No. Mic 59-3268)

Peter Sidney Knox-Davies, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor J. G. Dickson

Helminthosporium turcicum is variable in cultural characters and in pathogenicity. The present study was undertaken to evaluate mechanisms of variation in this important pathogen.

The cells of the vegetative hyphae were almost invari-

Interphase nuclei were usually spherical or subspherical to elongate. In many cases they were top-shaped or beaked, sometimes with a straight, rod-like projection extending from the beak. An examination of finer structural details showed that the typical interphase nucleus consisted of a matrix of thread-like chromatin material surrounding a deeply-staining spherical nucleolus. The regular outline of the nucleus at this stage suggested the presence of a nuclear membrane.

Nuclear division was rapid. Prometaphase, metaphase, late anaphase and telophase stages were distinguished but it was difficult to make accurate chromosome counts. The nucleoli were discarded at prophase or prometaphase and were reorganized in daughter nuclei at telophase. The most outstanding feature of nuclear division was that all the nuclei in a cell divided simultaneously.

Anastomoses and nuclear passage between hyphae were common in certain isolates.

Conidiophores and conidia were occasionally joined by wide cytoplasmic connections. They were multinucleate throughout their development. Mechanisms therefore exist for the perpetuation of heterokaryons through the conidium

Ascus development was studied in a cross between a dark and an albino isolate. Crozier formation was typical

and nuclear fusion occurred in the young ascus. Four nuclear divisions occurred in the ascus before there was evidence of ascospore delimitation. Further nuclear division took place in the ascospores. Cells of the mature ascospores were multinucleate. The occurrence of less than 8 ascospores in an ascus appeared to follow degeneration of nuclei rather than the incorporation of a number of division III nuclei in a single ascospore.

Single-ascospore cultures were obtained from a cross between an albino and a dark isolate. Of 169 cultures, 50 were albino, 117 were dark, and 2 were at first entirely dark but later gave rise to albino sectors. Of the 117 dark cultures, 31 were slow-growing but later formed sectors of vigorous mycelium. Ascus analyses indicated that the predominance of dark colonies was associated with degeneration in the ascus of nuclei with the factor for albinism. Sectoring of the single-ascospore cultures was attributed to the break-down of aneuploids into haploids.

Sectoring of single-ascospore cultures, chromosome counts, and irregularities in the appearance and behavior of nuclei and chromosomes in the asci indicate that aneuploidy occurs in <u>Trichometasphaeria turcica</u>. It is suggested that aneuploidy is a common phenomenon in the conidial stage of the fungus <u>H. turcicum</u>, and possibly also in other imperfect fungi.

Microfilm \$2.00; Xerox \$6.20. 126 pages.

#### STUDIES ON THE PREPARATION AND INFECTIVITY OF TOBACCO MOSAIC VIRUS NUCLEIC ACID.

(L. C. Card No. Mic 58-3786)

James Andrew Lippincott, Ph.D. Washington University, 1958

Chairman: Professor Barry Commoner

A modified heat denaturation method for the preparation of infectious nucleic acid from tobacco mosaic virus has been developed. The infectivity of ribonucleic acid prepared in this manner is ten times higher than the infectivities reported for tobacco mosaic virus ribonucleic acid isolated by other methods. Protein analysis, enzyme susceptibility and filtration experiments show that the infectivity of such nucleic acid preparations is not due to contamination with whole virus.

The lability of the infectivity of virus nucleic acid at relatively low temperatures and on heating suggests that either few hydrogen bonds are necessary for infectivity or that the loss of only a few results in inactivation. The infectivity of the ribonucleic acid is most stable in neutral salt solutions at concentrations of 10<sup>-1</sup> to 10<sup>-2</sup> M. Magnesium and calcium are more effective in stabilizing this infectivity than sodium when compared on an ionic strength basis.

Aggregation by alcohol precipitation or by precipitation with divalent metals largely inactivates the ribonucleic acid. When such precipitates are redissolved, infectivity is restored. The ribonucleic acid combines with acridine dyes with a resultant loss of infectivity. These results generally indicate that an unfettered ribonucleic acid molecule is necessary for infectivity.

The infectivities of both ribonucleic acid and tobacco

mosaic virus are strongly dependent on the ionic strength of the inoculation media and on the host plant. These effects can be used to differentiate between tobacco mosaic virus infectivity and the ribonucleic acid infectivity. Phosphate increases the infectivity of tobacco mosaic virus and of ribonucleic acid beyond the level expected from the solution's ionic strength alone. This effect appears to be due to (HPO<sub>4</sub>)--.

Chromatographic fractionation and ultracentrifugation of virus nucleic acid indicate that the preparations are quite heterogenous. The major portion of infectivity appears to be associated with a high molecular weight fraction which comprises about 5% of the total material.

Treatment of the virus nucleic acid with high concentrations of urea increases its ultraviolet absorbancy about 20% and decreases its intrinsic viscosity. These effects are suggestive of changes in the physical configuration of the nucleic acid, but are not accompanied by changes in infectivity. Microfilm \$2.00; Xerox \$7.00. 149 pages.

THE TETRAKAIDECAHEDRON AND RELATED CELL FORMS IN UNDIFFERENTIATED PLANT TISSUES

(L. C. Card No. Mic 59-3270)

Lazarus Walter Macior, Ph.D. The University of Wisconsin, 1959

Supervisor: Associate Professor Emma L. Fisk

Five kinds of mature, unspecialized, colorless plant tissues with regular columnar cell arrangements were studied in the living condition in sucrose solutions having concentrations determined as approximately isotonic with the vacuolar contents of the cells. The tissues and respective solutions were (1) Rhoeo discolor Hance upper subepidermal leaf parenchyma, 0.18 M, (2) Begonia ricinifolia A. Dietr., var. "Immense" leaf petiole parenchyma, 0.19 M, (3) Impatiens Balsamina L. stem pith, 0.19 M, (4) Coleus Rehneltianus Per. stem pith, 0.20 M, and (5) Asparagus Sprengeri Regel root tuber cortex, 0.26 M. Five tetrakaidecahedral cells and five other 14-faced cells chosen at random but restricted to having only quadrilateral, pentagonal, and hexagonal faces from each tissue were drawn and compared with the minimal tetrakaidecahedron of Kelvin. These cells were also compared with ten 14-faced cells from the irregularly arranged, colorless leaf parenchyma of Kleinia gomphophylla Dietr. immersed in 0.15 M sucrose solution in the living condition. No tetrakaidecahedral cells were found in Kleinia leaf parenchyma. Edge curvatures of all the cells from regularly arranged tissues resembled to a great degree those of the minimal tetrakaidecahedron, but some exceptions occurred. Edge curvatures of cells from irregularly arranged tissue exhibited a lesser degree of resemblance. Edges common to a pair of hexagonal faces in elongate tetrakaidecahedral cells and those closely related in form exhibited a sigmoid curvature thought to result from surface forces tending to equilibrate facial angles at cell vertices. Drawings of cell aggregates from the tissues and prepared slides of sections of five of the tissues in early stages of development were used to correlate regularity of tissue pattern with regularity of cell form and cell edge curvatures. Some

possible patterns of equational division of a 17-faced cell in hexagonally prismatic form were considered, and the resultant daughter cell possibilities were compared in form with data on cells previously studied by other investigators. It was concluded that cell form is determined by the mode of cell division and the activity of surface forces operating in conjunction with many other factors under conditions governed by definite mathematical and physical laws. Microfilm \$2.00; Xerox \$6.00. 125 pages.

STUDIES ON NORTHERN ANTHRACNOSE OF RED CLOVER AND ITS INCITANT, KABATIELLA CAULIVORA.

(L. C. Card No. Mic 59-3271)

James Pascal Martin, Jr., Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Earle W. Hanson

Northern anthracnose is a major disease of red clover and is widely distributed in the temperate climates of the world. It causes reductions in hay and seed yield and in forage quality. Resistant varieties constitute the only practical means of control. Most varieties contain some resistant plants but it has been difficult to separate these from susceptible plants. Breeders have lacked the necessary techniques. The present investigation was made to develop these techniques, to obtain further information concerning the pathogen, to determine the optimum conditions for disease development, and to investigate host-pathogen relationships.

Improved methods of isolating the pathogen, maintaining it in a sporulating and pathogenic condition in culture, increasing it in quantity, and applying it to the host were developed. The pathogen was isolated without difficulty from lesions on stems, petioles, and leaves. The most important factor in successful isolation was to incubate plated materials at 16° C. This temperature retarded the fungi which commonly overgrow Kabatiella caulivora at higher temperatures.

Since some isolates of <u>K</u>. <u>caulivora</u> quickly lose their pathogenicity as well as their ability to produce spores on culture media, attempts were made to overcome this difficulty. When cultures were grown on autoclaved red clover petioles or on potato-cerelose slants and covered with sterile mineral oil, they remained stable for 6 months, the duration of the test.

Small or large quantities of inoculum were produced in potato-cerelose broth in flasks on a mechanical shaker at 21-24°C in 1 week. A comparison of 1-, 2-, 3-, and 4-week-old inoculum showed that 1-week-old inoculum was best as indicated by both the percentage of plants infected and disease severity ratings. Severity ratings decreased sharply when inoculum older than 1 week was used but the percentage of plants infected decreased only slightly. Density of spores in the inoculum also influenced the amount of infection. At concentrations of 4,295,000 spores per ml, the average per cent of plants infected was 93. At concentrations of 7,250 per ml, only 3 per cent of the plants became infected. Inoculation in all experiments consisted in spraying a suspension of spores on the

above-ground parts of the plants with an atomizer. Optimum temperature for disease development was 20-24° C. Only a trace of disease occurred at 28°. Plants kept in a moisture chamber for 3-4 days immediately following inoculation developed most disease. Those given no moisture treatment developed no disease.

It was proved that <u>K. caulivora</u> could survive Wisconsin winters in lesions in infected stems, petioles, or leaves of red clover as well as in soil.

Studies on dissemination of the pathogen indicated that air currents can transmit the fungus when plants are wet but that they probably play only a minor role when the plants are dry. No evidence was obtained to indicate that insects disseminate the incitant.

Histological studies of leaf and petiole tissues showed that spores germinated in 12-24 hours and penetration of the host occurred in 48-72 hours. Penetration was direct; the fungus was never observed to enter through stomata. Hyphae remained adjacent to the epidermis in the cortex during early stages of disease development, later, they were not restricted to any specific tissue. The hyphae were both intercellular and intracellular.

Size of conidia collected from stem and petiole lesions of red clover grown in a field near Madison, Wisconsin, ranged in size from 3.9-30 microns long and 1.1-6.1 microns wide with most spores measuring 11-20 microns long by 3-4 microns wide.

A detached leaflet method was studied in preliminary tests to determine its usefulness in comparing the relative pathogenicity of different isolates of Kabatiella caulivora.

Microfilm \$2.00; Xerox \$4.00. 74 pages.

ETIOLOGY AND EPIPHYTOLOGY OF STRAWBERRY FRUIT ROT CAUSED BY BOTRYTIS CINEREA PERS.

(L. C. Card No. Mic 59-3412)

Robert Loran Powelson, Ph.D. Oregon State College, 1959

Major Professor: Edward K. Vaughn

Botrytis cinerea Pers. was found to be responsible for over 90 percent of the fruit rot that occurs in Pacific Northwest strawberry fields. A minor amount of fruit rot was being caused by Rhizopus nigricans Ehr., Rhizoctonia spp., Dendrophoma obscurans (E&E) Anderson, Gnomonia fructicola Arnaud and a species of Melanconium.

Since <u>Botrytis</u> rot proved to be the most prevalent field rot of strawberries, these investigations were conducted to determine (1) the source and distribution of inoculum; (2) the time, place, and method of infection; and (3) the factors affecting disease development.

Spore trapping experiments demonstrated the presence of viable Botrytis spores over and within a strawberry field during all seasons of the year. The relative spore density was low in January and February and did not increase rapidly until late in the harvest period. The number of spores trapped decreased rapidly with increasing vertical distance from the sporulation site. A primary source of inoculum for early infections is fructifications of B. cinerea on mummified fruits and plant debris which have remained overwinter within the strawberry field.

However, minor sanitary practices, e.g. foliage mowing and debris removal or the use of a dinitro, IPC and diesel oil winter weed spray did not reduce the incidence of fruit rot.

The predominant symptom of this disease in most cases was rot originating at the stem-end of the fruit. Evidence is presented which indicates that infection of senescent floral organs, followed by subsequent internal invasion of the receptacle is the primary pathway of infection. The results of isolation, incubation and histological studies revealed that a high percentage of the marketable and apparently disease free fruits examined had latent infection which was confined to the stem-end receptacle tissue and associated floral organs. Strawberries grown under conditions favorable for severe disease development were less susceptible to attack by B. cinerea when their petals, stamens and calyces were removed shortly after fertilization. Preharvest fungicide applications significantly reduced the incidence of rot in the field and the amount of latent infection of marketable fruits.

Attempts to correlate the effect of dry and wet environments on disease development indicate that under relatively dry macroclimatic conditions, sufficient moisture is present in the micro-environment of senescent floral organs for infection to occur. However, active rotting of infected fruits is associated with prolonged periods of precipitation and/or high humidities in the macro-environment

The results from varietal and fertilizer experiments indicate that the rate of rot development varies among different strawberry varieties and may be conditioned by mineral nutrition of the strawberry plant. The incidence of fruit rot was increased by fall application of supplemental nitrogen fertilizer and tended to be decreased by the use of potassium fertilizer. Under field conditions, Siletz and Northwest strawberries appeared to be considerably more susceptible to rotting than Marshall but in greenhouse and laboratory experiments, where strawberries of the same maturity were inoculated and incubated under similar conditions of temperature and humidity, this difference was not so great. In both varietal and fertilizer experiments, the rate of fruit rot development appeared to be affected more by the degree of water-soaking of tissues than by differences in varieties or fertilizer application. It is postulated that the rate of fruit rot development is related to the degree of water-soaking of tissues, which affects the activity of pectolytic enzymes produced by B. cinerea. Microfilm \$2.00; Xerox \$5.00. 100 pages.

STUDIES OF ACERIA TULIPAE KEIFER (ERIOPHYIDAE) AND OTHER ERIOPHYID MITES IN KANSAS IN RELATION TO THE TRANSMISSION OF WHEAT STREAK MOSAIC VIRUS.

(L. C. Card No. Mic 59-2999)

Maria Salome Escanilla del Rosario, Ph.D. Kansas State University, 1959

Aceria tulipae (Keifer), vector of wheat streak mosaic virus, has been reported on many plants by several workers. Several investigators implied that there might be strains of A. tulipae. This investigation was undertaken

to determine the presence of strains and to test these for transmission of wheat streak mosaic virus; and to find other eriophyid mites in Kansas that could thrive on wheat and transmit the virus. Other biological and ecological characteristics as well as mite rearing techniques were studied also.

The infestation and transmission characteristics on wheat by A. tulipae secured from A. smithii and onions suggest the possibility of strains and specific host relationships. Evidences for this contention are: 1) low percentage of infestation by mites from A. smithii (1.9%), and "imported" onion (9.23%) on wheat, 2) production of gall-like formations, 3) alterations of life history length and oviposition, 4) death of most of the first nymphal instar, 5) ability to transmit wheat streak mosaic virus varied with the different mites; A. smithii 1.03 per cent, "selected" A. smithii 31.6, "imported" onion 27.4, local onions 55.9, and wheat mite controls 85 to 100 per cent.

Corn and green foxtail may be substitute hosts for the virus and mite during summer. Onion and A. smithii may be alternate mite hosts and alfalfa a temporary or subsistent host.

Eriophyid mites such as <u>Vasates celtidis</u> and <u>Aceria</u> snetsingeri K., from hackberry, <u>Aceria sp.</u> from bermudagrass, <u>Aceria slykhuisi Hall</u>, from buffalograss and probably "<u>Cecidophyes</u>" hendersoni K., from yucca, did not colonize on wheat nor did they transmit the virus.

Eggs did not carry the virus and adults did not acquire the virus as adults. Mites from diseased plants placed on several culture media remained viruliferous for 18 days. Wheat streak mosaic virus can be recovered from inoculated wheat plants by mites or manual transmission techniques two days after the original inoculation.

From 3 to 21 eggs were laid by individual adults. Egg laying occurred during early morning and late afternoon.

Attempts to rear mite colonies on several culture media were unsuccessful but adult mites survived as long as 80 days although no egg laying occurred. Eggs hatched well but the nymphs did not survive. This technique was useful in determining accurately the number of eggs hatched at various temperatures, the longivity of adults and the persistence of the virus in the mite. The problem of keeping the agar sterile was solved by adding 1% Polymixin sulfate B at the rate of 1 cc. to 10 cc. of agar.

Egg hatching almost stopped at  $32 \pm 5^{\circ}$  F and mite population increase nearly ceased. At  $48 \pm 5^{\circ}$  F eggs hatched in 3 to 5 days; adults increased in number but were not as numerous as those kept at  $75 \pm 5^{\circ}$  F. Eggs and adults placed on culture media and kept at  $36 \pm 5^{\circ}$  F,  $48 \pm 5^{\circ}$  F and  $75 \pm 5^{\circ}$  F behaved differently than those placed on plants. Eggs did not hatch at  $36 \pm 5^{\circ}$  F, but when transferred to room temperature after one or two weeks hatching occurred. When the same procedure was repeated, after 3 to 4 weeks, no hatching occurred. At  $48 \pm 5^{\circ}$  F and  $75 \pm 5^{\circ}$  F, eggs hatched in 2 to 4 days.

Adults survived in sterile empty Petri dishes more than 8 hours at  $75 \pm 5^{\circ}$  F and between 30 to 40 hours at  $36 \pm 5^{\circ}$ F, indicating that A. tulipae are frequent feeders. A method of determining the distance travelled by the mite on a glass slide is described, the average walked in one hour being 4.6 cm.

Microfilm \$2.00; Xerox \$7.20. 151 pages.

## AUTECOLOGICAL STUDIES OF BITTERBRUSH (PURSHIA TRIDENTATA (PURSH) DC.).

(L. C. Card No. Mic 59-3415)

Frank Webster Stanton, Ph.D. Oregon State College, 1959

Major Professor: W. W. Chilcote

Bitterbrush (Purshia tridentata (Pursh) DC) is an important browse species on eastern Oregon ranges. Although it withstands heavy utilization well, many stands are deteriorating due primarily to human activity. There has been increasing interest in recent years in artificial seeding of browse species, especially bitterbrush, on depleted ranges. An understanding of the autecology of these species is a prerequisite to proper management.

Bitterbrush in Oregon is associated principally with Pinus ponderosa, Pinus contorta and Artemisia tridentata. It occurs at medium elevations where annual precipitation ranges between 12 and 25 inches. Soils are of light texture and at least three feet deep.

Typical, thrifty stands of bitterbrush in each major plant community in central Oregon were sampled with a point frame. Plant composition, density and cover values were determined. Bitterbrush heights and crown diameters were sampled along a transect in each plot, the plants were collected and ages determined by ring counts on 647 plants.

Root growth observations disclosed that the taproot penetrated to eighteen inches the first month and up to three feet before the summer drought period.

Layering was frequently observed but crown sprouting was rare.

Seeds remain viable for a period of years and have a pronounced internal dormancy. Seedlings are generally the result of rodent caches. Standard stratification treatment for eight weeks gave the best results for field planting. Significant differences were found in emergence of seeds from various sources. The mean germination of seeds from eight sources planted on a nursery plot was 46 percent. Seeds, rather than fruits, should be planted.

Two-week-old seedlings appeared to survive soil surface temperatures of approximately 150°F. applied for one hour.

Survival of 128 seedlings in twenty clusters planted by rodents in logged ponderosa pine areas in the Deschutes forest was 27 percent after four years.

Two exclosures were constructed in the Deschutes forest south of Millican, one in cut-over ponderosa pine and the other at the ecotone with big sagebrush. Plots were seeded during several successive seasons. Seventy percent of 1130 seedlings survived the first growing season; twenty-three percent remained after seven years on the forest area. Three seasons of similar plantings on the lower plots were almost complete failures. Chief causes of the difference are believed to be drying of the topsoil, depth of planting, rodents, and probably certain soil characteristics.

One-fourth of 1153 seedlings on an excellent nursery plot died within six weeks of emerging. Losses were attributed principally to rodents, rabbits and cutworms. Average survival after the first season was 43 percent; after three years, 34 percent. A record-breaking, sudden freeze in November of 1955 did not damage local seedlings.

BOTANY

An exclosure was erected on a deer winter range on the North Fork of the John Day river watershed. The heavy soil, rather high in pH and total bases, occurring on a south slope, was subject to severe surface crusting, frost heaving and water erosion. The combined effects of these factors were much more pronounced on cultivated plots. On non-cultivated plots mid-season mortality was greater due to competition for soil moisture. Early drying of the soil surface appeared to be the principal cause of preemergent mortality. Desiccation of stratified seeds was particularly noted. Fall seeding produced superior results. Rodents and insects contributed substantially to early seedling mortality. Transplanted nursery-grown seedlings resulted in sixty percent survival after one season and this method is recommended rather than seeding on similar Microfilm \$2.65; Xerox \$9.20. 203 pages.

### STUDIES ON LOCAL LESION FORMATION BY TOBACCO MOSAIC VIRUS.

(L. C. Card No. Mic 59-3792)

Jia-Hsi Wu, Ph.D. Washington University, 1958

Chairman: Barry Commoner

A technique was developed to characterize different infectious materials derived from tobacco mosaic virus and two of its mutants by measuring the rate of appearance of lesions, lesion size and the growth rate of lesions in addition to the number of lesions developed. The method was found to be useful in studying the physiology of infection and for genetic studies of tobacco mosaic virus and its strains. It was found that tobacco mosaic virus nucleoprotein, virus nucleic acid, and the nucleoprotein and nucleic acid of mutant strains exhibit characteristic varia-

tions in infectivity when tested on leaves from bean plants that differ in age. The common type tobacco mosaic virus nucleoprotein is infectious when tested on bean plants of various ages. However, the infectivity of tobacco mosaic virus nucleic acid is very sensitive to the age of the test bean plant, the number of lesions produced being drastically affected by only two days differences in age. Holmes' 1933 B4 mutant of tobacco mosaic virus was found to be more sensitive than common type tobacco mosaic virus to variations in age of test plants. In this regard B4 strain nucleoprotein is very similar to common type tobacco mosaic virus nucleic acid. The infectivity of the nucleic acid of the B4 strain is even more sensitive to plant age than B4 nucleoprotein.

When the rate of lesion development of tobacco mosaic virus nucleoprotein and its nucleic acid component were compared, it was found that the latter initiated lesions earlier and reached the maximum number of lesions faster than the virus. This suggests that the infectivity of tobacco mosaic virus nucleoprotein involves a release of its nucleic acid component to an infection site. Consequently, infectivity of the nucleoprotein involves a longer lag period than does nucleic acid infectivity. When the rate of lesion development of standard tobacco mosaic virus nucleoprotein, reconstituted tobacco mosaic virus nucleoprotein, and simple mixture of nucleic acid and protein without reconstitution, are compared, it is found that reconstituted nucleoprotein develops lesions considerably later than standard tobacco mosaic virus nucleoprotein. However, in the case of simple mixture of virus nucleic acid and protein this phenomenon was not observed. This effect shows that by reconstituting nucleic acid and protein components of tobacco mosaic virus, a specific complex is formed which behaves quite differently from the starting materials (nucleic acid and protein component of tobacco mosaic

The significance of these observations relative to our understanding of the virus infection process is discussed.

Microfilm \$2.00; Xerox \$5.40. 107 pages.

virus) in initiating an infection.

CHEMISTRY, GENERAL

SODIUM DIPHENYLAMINE SULFONATE AS AN ANALYTICAL REAGENT FOR OZONE.

(L. C. Card No. Mic 59-3315)

Harley Howard Bovee, Ph.D. University of Washington, 1959

Chairman: Rex J. Robinson

Sodium diphenylamine sulfonate has been selected as an analytical reagent for the determination of ozone. It dissolves readily in water to form colorless solutions of suitable concentration for efficient ozone reaction. The reagent reacts with ozone to form a turquoise blue product with an absorption maximum at 593 mu.

The reagent has been tested under various conditions to determine the effects of pH, temperature, concentration, type of sampling equipment, and rate of sample flow on its reaction efficiency. The effect of nitrogen dioxide, chlorine, hydrogen peroxide and other interferences have been investigated.

An analytical procedure using 1% sodium diphenylamine sulfonate, 0.02% perchloric acid has been developed and tested for precision. The analytical procedure has also been field tested with ozone formed by inert gas shielded welding arcs and by an electrostatic precipitator.

Microfilm \$2.00; Xerox \$4.80. 93 pages.

BEHAVIOR OF INDICATORS AND OTHER WEAK BASES IN ACETIC ACID SOLUTIONS.

(L. C. Card No. Mic 59-3181)

Kenneth Antonio Connors, Ph.D. University of Wisconsin, 1959

Supervisor: Professor Takeru Higuchi

The salt formation constant,  $K_f^{BHA} = C_{BHA}/C_BC_{HA}$ , is defined for the neutralization reaction B + HA ⇒ BHA and is taken to be a quantitative measure of the basicity of B against a reference acid HA in a given solvent. In the present investigation perchloric acid was the reference and acetic acid the solvent. The purpose of the study was

to develop methods for the evaluation of K<sub>f</sub> BHA for very weak bases. Two methods were devised, both involving photometric indicator titrations. Another aim of the research was to establish the usefulness of the salt formation constant as an index to structure-basicity relationships for these extremely weak bases; the data obtained suggest that such an application can be made.

(1) For the investigation of bases at least as strong as acetamide the modified type II plot, a refinement of an earlier method, serves well; it is based upon the equation

 $1/(X_2-X_1) = \overline{(X_{ex}/(S_2-S_1))} (I_b/I_a) + 1/(S_2-S_1)$ 

 $K_{ex} = K_f^{IHA}/K_f^{BHA}$  where I is an indicator base,  $I_b/I_a$  is

the ratio of base/acid forms of the indicator, X and S are milliliters of standard acid added at any point and at the equivalence point, respectively. Two samples, differing only in size and denoted by 1 and 2, are titrated. A graph of  $1/(X_2-X_1)$  vs  $I_b/I_a$  is linear and yields the end point (S2-S1) and exchange constant (Kex). The indicators employed were Sudan III, Nile blue A, p-naphtholbenzein, and malachite green. Bases titrated were acetophenetidin, acetamide, urea, 2,6-dimethyl-γ-pyrone, thiourea, caffeine, antipyrine, isonicotinic acid, and triphenylguanidine. The relative precision of the exchange constants is about 5%. The quantitative recoveries of 20-30 mg samples of all bases were 98-101%.

(2) A method has been developed which permits the evaluation of individual indicator formation constants. Consideration of the indicator equilibrium (taking into account water present as an impurity) leads to the equation

 $1/Q_f^{IHA} = K_f^{WHA}C_{H_2O}/K_f^{IHA} + 1/K_f^{IHA}$ 

Kf is the formation constant for water perchlorate,  $C_{H_2O}$  is the water concentration, and  $Q_f^{IHA}$  is given by

 $Q_f^{IHA} = (I_a/I_b)V/N(X-R)$ 

V is the total volume of titration solution, N is the titrant normality, X has the significance assigned previously, and R is the volume of titrant equivalent to the acid bound as indicator salt; R is calculated from the spectral data.  $Q_f^{IHA}$  is found from a plot of  $I_a/I_b \underline{vs}$  (X-R). A plot of 1/Qf vs CH2O then gives values of Kf WHA and Kf Kf is found to be 38 + 8.

In a variation on this method a weak base B is included in the system. If the condition  $K_f^{WHA}C_{H_2O} \ll K_f^{BHA}C_B$  is satisfied, a plot of 1/Qf vs CB will yield the value of Kf according to an equation similar to the one above. Bases studied in this way were salicylamide, benzamide,

acetanilid, and acetophenetidin.

Combination of the results of the two methods permits calculation of the formation constants for all of the weak bases studied. These bases and the logarithms of their perchlorate formation constants are: salicylamide, 2.68; benzamide, 2.85; acetanilid, 2.96; acetophenetidin, 3.51; acetamide, 4.04; urea, 4.93; 2,6-dimethyl- $\gamma$ -pyrone, 5.15; thiourea, 5.18; caffeine, 5.38. The indicator perchlorate formation constants are: Sudan III, 2.96; Nile blue A, 4.59; p-naphtholbenzein, 5.04; malachite green, 5.26. The uncertainties in these values range from 0.04 to 0.1 unit. Microfilm \$2.00; Xerox \$5.20. 103 pages.

## CONSTRUCTION AND APPLICATION OF A NEW TYPE OF THERMOBALANCE.

(L. C. Card No. Mic 59-3360)

Frank Allen Iddings, Ph.D. The University of Oklahoma, 1959

Major Professor: Ernest E. Byrn

The increasing use of thermobalances for the determination of purity, composition, and treatment of precipitates, the study of corrosion and solid state reactions at high temperatures, and the analysis of solid fuels, clays, and reagents has established such instruments as valuable research tools for the chemist. Although several commercial thermobalances are available, each possesses disadvantages such as excessive cost, open furnaces, complicated construction and poor versatility. Such disadvantages prohibit the building or purchase of such instruments by laboratories operating on a modest budget. A new type of thermobalance was designed and built eliminating the objectionable features of the commercial instruments.

A bifunicular silica torsion balance is the heart of the instrument. This small but rugged balance is mounted in a glass case fitted with ground glass joints allowing complete isolation of the balance and sample from external conditions. Movement of the balance beam from a null position, as the result of change in weight of the sample, actuates a servo-mechanism controlling the position of the beam through the use of a magnet and field coil.

Current through the field coil is proportional to the sample weight. The potential drop across the field coil provides a signal to a recorder producing an automatic plot of sample weight versus time. Since the heating rate is known, time may be converted into temperature.

Sample weight versus temperature curves (thermolysis curves) for several substances have been produced and compare favorably with similar curves obtained with other instruments. Some of the samples were pyrolysed in nitrogen or at reduced pressure to illustrate the advantages of the isolated sample. Over 25 thermolysis curves obtained with the new thermobalance are presented with a brief interpretation of the salient portions of the curves.

Microfilm \$2.00; Xerox \$3.00. 58 pages.

CHEMISTRY, BIOLOGICAL

PHYSICAL AND CHEMICAL CHANGES
PRODUCED BY CHYMOTRYPTIC PROTEOLYSIS
OF CASEINS.

(L. C. Card No. Mic 59-2629)

Rashid Ahmad Anwar, Ph.D. Michigan State University, 1957

Major Professor: H. A. Lillevik

A study was made of the action of chymotrypsin upon whole casein and its purified alpha and beta fractions in

more or less systematic manner, since very little such work appears to have been reported with this enzyme.

Proteolysis of 3 per cent caseins (whole, alpha or beta) with 0.010 or 0.0165 mg. crystalline chymotrypsin per ml. of digest at pH 7.5 was studied by: electrophoresis; titration in aqueous, alcohol or acetone media; conductivity change; and analysis for nitrogen and phosphorus products made soluble in 10 per cent trichloroacetic acid (TCA).

By moving boundary electrophoretic analysis of isoelectric precipitable products in 0.1M veronal, pH 8.6, it was noticed that both major components of whole casein gradually disappeared. Initially a split in the alpha peak was observed but this was followed by increasing development of both faster and slower peaks.

The same digestion mixture run at pH 5.6 by dilution with an equal volume of 1 M acetate buffer produced a precipitate (at 30°C.) which, after washing and reprecipitations, showed electrophoretically a single component with a mobility of 5.3 Tiselius units. Repeating the experiment upon pure preparations of alpha or beta casein produced the same result. If a sample of the precipitate from alpha or beta casein was mixed with a sample of the precipitate from whole casein the electrophoretic pattern of the mixture again showed a single peak of the same mobility. This casein derivative from whole casein showed two peaks in the ultracentrifuge with sedimentation coefficients of 7.45 (Svedbergs) in peak 1, and 36.4 (Svedbergs) in peak 2, when extrapolated to zero concentration. Its isoelectric point was found to be pH 6.1 and its phosphorus and nitrogen were 0.3 and 15.1 per cent respectively.

The greater titration increments of potassium hydroxide in alcohol, shown by all casein chymotryptic digests (at 30°C) at pH 7.5, compared with those in either aqueous medium or with hydrochloric acid in acetone, indicate the liberation of acid groups additional to those derived from peptide bond hydrolysis. This suggestion is further substantiated by the finding in these casein digests of phosphorus products (mostly inorganic P) soluble in 10 per cent TCA.

The rate and extent of liberation of TCA soluble phosphorus was greatest from digests of alpha casein and least from those of beta. The inorganic portion of the total acid soluble phosphorus was greater from all preparations. The organic phosphorus portion which was the least of the total TCA soluble, was released more from whole casein than that from alpha casein.

One dimensional paper chromatography of TCA soluble products from whole and alpha caseins showed 2 ninhydrin spots (peptides) with high  $R_{\rm f}$  values. The same two spots could be detected from early stages and upwards to 4 hours of digestion. Beta casein TCA soluble products showed mainly one spot with an  $R_{\rm f}$  corresponding to the faster derived from whole or alpha casein.

The hydrolysates of TCA soluble peptides from whole alpha and beta caseins showed in each case identically 12 amino acid spots by two dimensional paper chromatography which were positively identified. In addition to these residues TCA soluble peptides from whole and alpha casein were found to contain tryptophan, showing that the fast moving peptide(s) common to all 3 proteins did not contain tryptophan. Microfilm \$2.00; Xerox \$5.60. 113 pages.

FOUR SYSTEMIC INSECTICIDES AS ALFALFA SEED TREATMENTS; A STUDY OF THEIR EFFECTIVENESS AGAINST THE SPOTTED ALFALFA APHID AND OF THEIR PHYTOTOXICITY.

(L. C. Card No. Mic 59-2991)

Jack Lynn Bishop, Ph.D. Kansas State University, 1959

The application of four systemic insecticides to alfalfa seed as a method of controlling the spotted alfalfa aphid was investigated along with the effects of these treatments on germination, emergence, and general plant growth. This manner of applying insecticides for the protection of young seedling plants overcomes many of the disadvantages encountered in the use of conventional contact insecticides.

Korlan, Thimet and Di-Syston were employed as dry seed treatments, each tumbled onto seeds at the rates of one, two, and four pounds of toxicant per 100 pounds of seed although the amounts of toxicant per 100 pounds of seed that actually adhered to the seed were 0.82, 1.64 and 3.28 pounds, respectively. Systox was applied as a seed soak; the treatments being 0.25 per cent Systox in water in which seeds were soaked one-half hour, and 0.5 per cent Systox in water in which seeds were soaked one-half hour for one treatment and one hour for another. Methyl cellulose at 2 per cent of the weight of the formulation used in the treatments was added as a sticking agent. Methyl cellulose-treated checks and untreated controls were used in all tests.

Tests were conducted on Buffaio and Kansas Common alfalfa seeds planted immediately, one week, one month, six months, and one year after treatment, in the interim being stored in quart mason jars.

Since alfalfa seedlings are most vulnerable to aphid attacks the first six weeks of their growth, the effectiveness of the treatments was tested through a six-week period.

Tests conducted at the State Seed Laboratory, Topeka, showed that the Thimet, Korlan, and Di-Syston treatments did not reduce germination. Systox-treated seed germinated poorly after six months storage because of inadequate drying after treatment.

Seeds were planted in soil flats at Manhattan for emergence studies. The Korlan and Systox treatments reduced emergence; the other treatments showed no reduced emergence.

Di-Syston proved an effective aphicide for the entire six-week period at each of the plantings, and, although the two and four pound rates appeared better to the observer, statistical analysis showed no significant differences among the three rates.

The four pound rate of Thimet was as effective as the Di-Syston treatments, but the one and two pound rates of Thimet did not give satisfactory control for the entire six-week periods.

Systox and Korlan treatments did not give satisfactory control.

Storage did not alter the aphicidal effectiveness of the seed treatments nor did it increase the phytotoxicity except in the Systox treatments.

An additional measure of phytotoxicity was employed by comparing dry weight ratios of top growth-root growth.

There were, in general, no marked differences between the ratios of treated and untreated plants.

Microfilm \$2.00; Xerox \$3.00. 50 pages.

## COMPARATIVE BIOCHEMISTRY OF THE DECAY OF SWEETGUM SAPWOOD BY WHITE AND BROWN ROT FUNGI,

(L. C. Card No. Mic 59-3182)

Ellis Brevier Cowling, Ph.D. University of Wisconsin, 1959

Supervisors: Dr. T. C. Scheffer and Dr. A. J. Riker

Determinations were made of the nature and relative rates of enzymatic effects on sweetgum sapwood (Liquidambar styraciflua L.) during decay by the representative white rot fungus, Polyporus versicolor L. ex Fr., and the brown rot fungus, Poria monticola Murr. Samples of the test wood, ranging in extent of decay from incipient to advanced stages, were submitted to solubility, composition, degree of polymerization, hygroscopicity, X-ray diffraction, and histological analyses.

The results of the solubility analyses, when expressed as percentages of the original sound wood, revealed little change in solubility with increasing extent of white rot. Brown rotted wood showed progressively increasing solubility in the initial stages of decay, and decreasing solubility in later stages. The water and alkali extracts of brown rotted wood contained appreciable amounts of lignin as well as reducing substances.

The composition analyses revealed depletion of all major wood constituents by Polyporus versicolor, at rates approximately proportional to the amounts present in sound wood. Poria monticola primarily utilized the wood carbohydrates, each at a different rate during the various stages of decay.

Polyporus versicolor gradually reduced the average degree of polymerization of the holocellulose of the wood. The corresponding changes in brown rotted wood were very rapid in the initial stages of decay, and similarly gradual thereafter.

The white rotted wood showed a small increase in hygroscopicity in advanced stages of decay. The brown rotted wood showed a rapid initial decrease, followed by a more gradual reduction in hygroscopicity.

The X-ray diffraction analyses revealed a small decrease in proportion of crystalline material in white rotted wood, and a more pronounced decrease during brown rot, after 10 percent weight loss.

The histological analyses of white rotted wood revealed general thinning and increase in porosity of the cell walls, dissolution of pit pairs, and bore hole formation by Polyporus versicolor. Bore holes were the primary visible evidence of cell wall deterioration by Poria monticola.

The following major conclusions are supported by the above analytical results: The white rot fungus, Polyporus versicolor, utilized all major constituents of both the crystalline and amorphous regions of the wood, at rates approximately proportional to the amounts present in sound wood. Each constituent was respired about as rapidly as it was depolymerized. The extracellular enzymes of

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this organism acted primarily on the surfaces of fibrils exposed in the lumens and within the walls of the wood cells. This gave rise to porous and general thinning patterns of dissolution of the cell wall substance. Lignin apparently was removed from the interstices between fibrils in the earliest stages of decay, and from the compound middle lamella in later stages. The wood polysaccharides were depolymerized by an endwise mechanism, or were attacked from the cellular and fibrillar surfaces in such a way that those remaining after various stages of decay only gradually were reduced in degree of polymerization.

The brown rot fungus, Poria monticola, primarily utilized the wood carbohydrates, each at a different rate. Lignin utilization was slight, although profound changes were induced in its solubility properties. In the initial stages of decay, the wood constituents were depolymerized more rapidly than the degradation products were respired; the reverse was true in later stages. The carbohydrases of Poria monticola readily entered the amorphous regions of the cell walls, and there catalyzed the rapid depolymerization of the wood polysaccharides by a random mechanism. Utilization of crystalline cellulose was delayed and proceeded much more slowly.

The differences in rate of depolymerization of the wood carbohydrates shown by the two test fungi were considered to account for the differences in strength, pulping properties, solubility, dimensional stability, and surface appearance of white and brown rotted wood in general.

Microfilm \$2.10; Xerox \$7.40. 157 pages.

STUDIES ON THE METABOLISM AND RESIDUES OF CERTAIN PHOSPHORODITHIOATE INSECTICIDES.

(L. C. Card No. Mic 59-3246)

Walter Carl Dauterman, Ph.D. The University of Wisconsin, 1959

Supervisors: Professors Richard D. O'Brien and John E. Casida

The metabolism of the phosphorodithioate insecticide, Dimethoate, O,O-dimethyl S-(N-methylcarbamoylmethyl) phosphorodithioate by mammals and plants was studied using radiotracer and chromatographic techniques.

After oral administration to rats and cows Dimethoate was hydrolyzed at a number of sites on the molecule. The major site of hydrolysis by mammals, occurred at the amide C-N bond, resulting in the excretion of O,O-dimethyl S-carboxymethyl phosphorodithioate in the urine. Other non-toxic metabolites eliminated in the urine were dimethyl phosphate, O,O-dimethyl hydrogen phosphorothioate, O-methyl O-hydrogen S-(N-methylcarbamoylmethyl) phosphorodithioate, and O,O-dimethyl hydrogen phosphorodithioate. Since the rat and cow showed similarities in the types of metabolites and the amounts excreted in the urine, the metabolism of Dimethoate in cows and rats can be assumed to be the same. No phosphate analog (O,O-dimethyl S-(N-methylcarbamoylmethyl) phosphorothiolate) was isolated in the excreta, secreta or tissues of cows but small amounts must have been present since there was

evidence of  $\underline{\text{in}}$   $\underline{\text{vivo}}$  cholinesterase depression and Dimethoate itself is  $\overline{\text{a}}$   $\underline{\text{poor}}$  anticholinesterase in vitro.

The level of radioactive materials appearing in the jugular blood of the cow reached a peak 3 hours after treatment and this peak coincided with the maximum amount of radioactivity in the fat. The total residues in the milk decreased rapidly with time after treatment and only trace amounts of chloroform extractable residues were found after 48 hours. Of the various tissues analyzed in the rats and cows, the liver, kidney, heart and brain contained the highest amount of Dimethoate residues.

Dimethoate applied to plants rapidly penetrated into the leaves in the case of potato, cotton, and corn. The Dimethoate which was absorbed into the leaf was degraded faster than that remaining on the leaf surface. The N-ethyl analog of Dimethoate, CL 18,706, showed the same pattern of rates of absorption and degradation in cotton as Dimethoate. The phosphate analog was isolated both from the surface and from inside the leaf, but never represented more than 25% of the solvent-extractable fraction. Oxidation to the phosphate within the leaf was enzymatic whereas oxidation on the surface was non-enzymatic.

Four water soluble metabolites of Dimethoate were found in all plants: dimethyl phosphate, O,O-dimethyl hydrogen phosphorothioate, O,O-dimethyl S-carboxymethyl phosphorothiolate and O-methyl O-hydrogen S-(N-methyl carbamoylmethyl) phosphorodithioate. The predominant metabolite found on the surface of the leaves was O,O-dimethyl S-carboxymethyl phosphorothiolate while within the leaves the major metabolite was O-methyl O-hydrogen S-(N-methylcarbamoylmethyl) phosphorodithioate. Dimethoate was rapidly degraded in plants and one month after treatment only trace amounts of the toxic components were found.

Microfilm \$2.00; Xerox \$3.80. 69 pages.

#### PIGMENTS OF PHYSARUM POLYCEPHALUM.

(L. C. Card No. Mic 59-3183)

Carlton Francis Dresden, Ph.D. University of Wisconsin, 1959

Supervisor: Professor F. M. Strong

The object of this study was to isolate the pigment(s) of <a href="Physarum">Physarum</a> polycephalum in pure form and to characterize them.

The extraction of the original mycelium could be carried out with any of several solvents, acetone extraction of the fresh mycelium giving the best results.

The best preparation represented about a 150 fold concentration over the crude extract, but no crystalline pigment has been obtained. The fact that the best preparation was chromatographically homogeneous when chromatographed on paper with three solvent systems pointed to its probable high purity.

At least four closely related individual pigments were shown to be present in a one hundred fold concentrate of the original extract.

The pigment behaved like a fairly strong organic acid being insoluble in aqueous acid solutions but soluble in 5 per cent aqueous sodium bicarbonate solution. The presence of five amino acids has been shown in an hydrolysate of the best pigment preparation, whereas no free amino acids were present before hydrolysis.

A quantitative elemental analysis on the best preparation showed 55.59 per cent carbon, 7.18 per cent hydrogen, and 3.12 per cent nitrogen.

Classification into a known pigment group has not been possible. Microfilm \$2.00; Xerox \$6.20. 129 pages.

# THE NUTRITIONAL REQUIREMENTS AND EXCRETORY PRODUCTS OF AXENIC ASCARIS LUMBRICOIDES VAR SUIS.

(L. C. Card No. Mic 59-3184)

Theodore Ellison, Ph.D. University of Wisconsin, 1959

Supervisors: Professors A. C. Todd and F. M. Strong

Detailed information about the nutritional requirements and metabolism of <u>Ascaris</u> are needed to provide a basis for a rational chemotherapeutic attack on the parasite. Although considerable progress has been made in the past few years in studies of <u>Ascaris</u> metabolism, very little is known concerning its in vitro nutritional requirements.

Part I. Studies of the effects of nutritional requirements on in vitro survival of axenic Ascaris lumbricoides.

The utilization of mixtures of antibiotics has made it possible to maintain cultures of Ascaris under axenic conditions so that experiments can be carried out without the interfering presence of bacteria. All data were analyzed statistically at the 95% and 99% levels of significance using the "t" test.

The addition of glucose or fructose to a basal salts medium at either 0.2 or 0.5% concentrations resulted in highly significant increases in in vitro survival.

Investigations were made on the effects on in vitro survival of the removal of single L-amino acids from a complete medium. Highly significant decreases in Ascaris survival resulted from media deficient in the following amino acids (in order of decreasing effects): tryptophan, phenylalanine, cysteine, threonine, arginine, lysine, histidine, tyrosine, methionine, glutamic acid, leucine, alanine and serine.

The complete synthetic medium consisted of basal salts, glucose (0.2%), twenty L-amino acids and twelve water-soluble vitamins in a phosphate buffer (pH 7.2). Maximum survival of the Ascaris maintained in the complete medium was 50 days with a mean survival of 36.2 days.

Part II. Studies of the effects of nutritional requirements upon the chemical composition of axenic Ascaris lumbricoides.

Investigations have been concerned with the effects of carbohydrates, amino acids and water- and fat-soluble vitamins on the moisture, protein, fat, and glycogen composition of <u>Ascaris</u> maintained in vitro for prolonged periods.

The addition of glucose, fructose and sucrose to a basal

salts medium resulted in the conservation of the glycogen contents of worms maintained in vitro. Studies were made on the chemical composition of Ascaris maintained in media to which twenty L-amino acids were added singly at three concentrations. Amino acid concentrations were then selected for the complete medium on the basis of conserving the glycogen and fat stores of Ascaris and in increasing in vitro survival.

On the 50th day after removal from the swine host, the last Ascaris died in the complete medium and analyzed 6.02% glycogen, 3.05% fat and 9.43% protein (based on wet weight). Analyses of the last basal salts control worm that died on the 19th day were 0.07% glycogen, 3.98% fat and 9.54% protein (based on wet weight).

Part III. The separation, isolation, and identification of the methyl esters of the volatile fatty acids excreted from axenic Ascaris lumbricoides.

The volatile fatty acids excreted by axenic Ascaris were isolated from the culture medium. After methylation of the fatty acids ten methyl ester peaks, three major and seven minor, were detected on a gas-liquid chromatogram. All were tentatively identified by comparison with the relative retention times of comparable standards under the same conditions.

The three major components were more positively identified by infra-red spectroscopy and the preparation of amide derivatives. They were shown to be  $\alpha$ -methyl n-butyric, isovaleric, and iso-caproic acids. The minor acid components were acetic, propionic, iso-butyric, n-butyric, cis- $\alpha$ -methyl crotonic (tiglic), n-caproic, and an unknown branched  $C_7$  acid.

The total mole percentages of the excreted volatile fatty acids were (based on number of carbon atoms): C<sub>2</sub>, 0.27%; C<sub>3</sub>, 0.77%; C<sub>4</sub>, 1.14%; C<sub>5</sub>, 38.02%; C<sub>6</sub>, 56.24% and C<sub>7</sub>, 3.56%. Microfilm \$5.95; Xerox \$20.80. 468 pages.

THE INTERRELATIONSHIP OF PHOSPHORUS, SULFUR, COPPER, AND MOLYBDENUM ON CELLULOSE DIGESTIBILITY BY RUMEN MICROORGANISMS AND IN RAT METABOLISM.

(L. C. Card No. Mic 59-3544)

Joseph Liston Evans, Ph.D. The University of Florida, 1959

Three experimental programs were carried out to determine the effect of the interrelationship of phosphorus, sulfur, copper, and molybdenum on cellulose digestion by rumen inoculum using in vivo and in vitro techniques and on growth and bone formation in rats.

In the first group of experiments, an in vivo bag technique was evaluated and found satisfactory for comparing cellulose digestion from different sources. Digestion of cellulose from Solka-Floc was highest; cotton linters, intermediate; and sugar can bagasse, lowest. This in vivo bag technique was used in determining the effect of the interrelationship of phosphorus, sulfur, and molybdenum on the digestion of cellulose from the above sources. A total phosphorus of 0.54 per cent in the steer ration

slightly reduced cellulose digestion. An addition of 0.40 per cent sulfur to the ration, which contained 0.15 per cent sulfur and 1.46 per cent nitrogen of which two-thirds was supplied by urea, increased cellulose digestion. Sulfur or phosphorus supplementation increased the respective concentrations of these elements in the rumen liquid. With advancing age, cattle may become more efficient in cellulose digestion.

In the second group, an artificial rumen technique was used to study cellulose digestion. As in the in vivo data, digestion of cellulose from Solka-Floc was highest; cotton linters, intermediate; and sugar cane bagasse, lowest. Grinding cotton linters and sugar cane bagasse improved cellulose digestion for each. Addition of either sulfur or phosphorus to rumen inoculum improved cellulose digestion, and the improvements appeared additive. In the presence of a high phosphorus level, when either copper or molybdenum was present at a level that depressed cellulose digestion by rumen inoculum, the addition of the other lessened the severity of the depression. Added sulfur reduced the depression produced by excessive copper. In the 24 factorial experiment which included phosphorus, sulfur, copper, and molybdenum, effects of molybdenum and remaining first and second order interactions not mentioned above were not different from the experimental mean but were lower than the optimum control.

In the third group, weight gains, milligrams ash per femur per gram of live weight, percentage femur ash, and femur ash were used as criteria to evaluate the effect of the above mineral interrelationships on growth and bone formation in weanling rats. Hemoglobin, percentage femur and liver phosphorus, and percentage liver copper were determined for a limited number of females.

Although females had a higher amount of femur ash per unit of live weight than males, they had lower weight gains and femur ashes. A sulfur addition to an 18 per cent casein ration stimulated growth in both sexes. In the absence of added sulfur, weight gains and femur ashes were depressed more in males than in females by the addition of 0.78 per cent phosphorus which was counteracted by added sulfur. This high dietary phosphorus level increased liver phosphorus and decreased femur phosphorus for females. The sulfur addition decreased the phosphorus concentration of the femur but not so much as that produced by the high phosphorus. The sulfur supplementation partially counteracted the lowered femur phosphorus produced by the high phosphorus. In the presence of this high phosphorus, a molybdenum addition depressed weight gains and femur ashes for females but increased them for males. However, the depression caused by molybdenum was reversed by the simultaneous addition of copper and sulfur but not by either alone. A sulfur addition of 0.66 per cent was toxic.

Phosphorus, sulfur, copper, and molybdenum are interrelated in many ways which affect liver copper concentrations. The addition of sulfur caused a lowering of liver copper while added phosphorus, copper, and molybdenum caused an increase.

Microfilm \$2.00; Xerox \$6.60. 138 pages.

THE ENZYMATIC DEPHOSPHORYLATION OF PHOSPHORYLASE a AND DERIVED PHOSPHOPEPTIDES.

(L. C. Card No. Mic 59-3325)

Donald John Graves, Ph.D. University of Washington, 1959

Chairman: Dr. Edwin G. Krebs

The PR enzyme catalyzed conversion of phosphorylase  $\underline{a}$  to  $\underline{b}$  has been investigated by using  $P^{32}$ -labeled phosphorylase  $\underline{a}$ . The equation for the reaction can be written as follows:

phosphorylase  $\underline{a} \longrightarrow 4 P_i + 2 phosphorylase \underline{b}$ 

The nature of the conversion reaction is discussed.

The phosphate bond introduced in the phosphorylase beto a reaction and in phosphohexapeptide C is stable to acid and labile to base. This behavior excludes a "high energy" type of phosphate linkage but is characteristic for phosphoproteins and phosphopeptides in which the phosphate group is linked to an O-seryl residue.

The structure of phosphohexapeptide C released from phosphorylase a by tryptic attack has been determined by enzymatic degradation and end-group analysis to be as follows: Lys-Glu(-NH<sub>2</sub>)-Ileu-Ser(-OP)-Val-Arg. A non-enzymatic deamination and cyclization of Peptide B, Glu (-NH<sub>2</sub>)-Ileu-Ser(-OP)-Val-Arg. to Peptide A, PLC-Ileu-Ser(-OP)-Val-Arg. has been described.

The substrate specificity of PR enzyme has been studied. PR enzyme has been found to be entirely specific for one phosphoprotein, phosphorylase a, or for phosphopeptides derived from it. The dephosphorylation of Peptides A, B, and C by PR enzyme has been determined to be approximately 20 times slower than the dephosphorylation of phosphorylase a. The phosphopeptide, Lys-Glu(-NH<sub>2</sub>)-Ileu-Ser(-OP)-Val. is not attacked by PR enzyme. The requirement of an arginyl residue in the phosphopeptides for PR enzyme activity on these substrates, and the slower rate of dephosphorylation of Peptides A, B, and C is discussed.

The accessibility of the phosphate bond in phosphorylase a to attack by non specific phosphatases has been examined. Prostate phosphatase, potato phosphatase, and alkaline intestinal phosphatase do not dephosphorylate phosphorylase a.

Microfilm \$2.00; Xerox \$3.80. 70 pages.

## OXIDATIVE PHOSPHORYLATION AND RESPIRATORY CONTROL IN INSECT MITOCHONDRIA.

(L. C. Card No. Mic 59-3405)

Charles Thornton Gregg, Ph.D. Oregon State College, 1959

Major Professor: LeMar F. Remmert

Methods are described for the isolation of housefly mitochondria of high metabolic activity and considerable stability. These mitochondria oxidize the principal products of insect glycolysis (pyruvate and alpha-glycerophosphate) at a substantially higher rate and with a greater production of energy than has been reported previously, as well as rapidly oxidizing other citric acid cycle intermediates. The significance of these observations with respect to the source of energy for insect flight is discussed.

These insect mitochondria resemble those from higher animals in their capacity for energy production, the metabolic pathway by which this energy is produced, and the mechanism of respiratory control. These observations are at variance with other investigations which have suggested that insect mitochondria utilize unique metabolic pathways for energy production and unusual mechanisms for respiratory control.

The isolation medium developed during this work appears superior to other media, used in similar studies, but the reasons for this superiority are not completely understood. The results obtained suggest that the medium and isolation technique used here may inhibit the formation and/or release of factors, derived from the mitochondrion, which have been shown to uncouple oxidative phosphorylation and to release respiration from its dependence on a phosphate acceptor.

The uncoupling agent 2,4-dinitrophenol, and the insecticide, DDT, have been tested for their effects on oxidative phosphorylation, ATPase activity, and the ATP-P<sup>32</sup> exchange reaction. In confirmation of earlier studies DDT was shown to inhibit oxidative phosphorylation at low concentrations. DDT also inhibited the DNP-stimulated ATPase, and the ATP-P<sup>32</sup> exchange, but not the Mg<sup>++</sup>-stimulated ATPase. From these results a tentative assignment of a site of action for DDT has been made.

Dinitrophenol has been found to uncouple oxidative phosphorylation, stimulate ATPase and inhibit the ATP-P<sup>32</sup> exchange, as it does in mammalian mitochondria. However, the surprising observation was made that DNP failed to release respiration in the absence of ATP. The speculation is advanced that this failure may indicate a difference between insects and higher animals with regard to the components or mechanism of oxidative phosphorylation. A possible explanation for the failure of DNP to release respiration in the absence of ATP is presented.

Microfilm \$2.00; Xerox \$4.40. 85 pages.

CITRIC ACID METABOLISM IN RELATION TO VITAMIN D AND CALCIFICATION.

(L. C. Card No. Mic 59-3191)

Gordon Guroff, Ph.D. University of Wisconsin, 1959

Supervisors: Professor Harry Steenbock and Dr. Hector F. DeLuca

It is well established that the administration of vitamin D elevates tissue and urinary citric acid content. To obtain information on the role of this elevation in vitamin D-induced calcification, the effects of various vitamin deficiencies on the two actions of vitamin D have been studied in rats. It was found that pantothenic acid and pyridoxine deficiencies prevent the rise in urinary and

extra-skeletal tissue citric acid. Pyridoxine deficiency suppressed the rise in bone citric acid as well. The reduced citric acid levels were not due to inanition and could not be produced by biotin deficiency.

Rachitic, pantothenic acid deficient rats deposit as much bone ash when given only vitamin D as when they are given vitamin D and pantothenic acid. Bone citric acid is also equally elevated by the two treatments but blood citric acid rises only in response to vitamin D and pantothenic acid. Similar results were obtained with pyridoxine deficiency. In this case, however, neither bone nor blood citric acid is elevated as much by vitamin D alone as it is by vitamin D and pyridoxine. These experiments indicate that neither bone nor blood citric acid elevation is directly responsible for the vitamin D-induced calcification.

The determination, by ion-exchange chromatography, of kidney acids of rats fed various diets with and without vitamin D revealed that only the citric acid fraction was significantly affected by the vitamin. This indicates that the action of vitamin D is specifically on citric acid metabolism and is not of a general nature.

The metabolic origin of the increased citric acid due to vitamin D has been investigated with kidney slices. Vitamin D supplementation failed to increase the incorporation of acetate-1-C<sup>14</sup> into citrate, other acidic fractions, or carbon dioxide. Furthermore it had no effect on the disappearance of citrate-1,5-C<sup>14</sup> incubated with kidney slices. Therefore, no evidence for either increased synthesis or decreased destruction of citric acid in animals given vitamin D has been obtained.

Microfilm \$2.00; Xerox \$5.20. 105 pages.

#### PRODUCTION OF POLYHYDRIC ALCOHOLS BY YEASTS.

(L. C. Card No. Mic 59-3256)

William Fred Hendershot, Ph.D. University of Wisconsin, 1959

Supervisor: Professor W. H. Peterson

Glycerol production by "steered" fermentation has been studied extensively over the years. In the work reported herein, fermentation conditions were investigated with selected cultures whereby good yields of polyols were obtained in the absence of steering agents, thus greatly facilitating recovery of desired end products.

Part I involved studies on the screening of yeast mutants. Strains of Torula utilis-3 and Saccharomyces cerevisiae-WY38 were subjected to ultraviolet irradiation in order to produce mutants. The search for a culture lacking the alcohol dehydrogenase system and thus able to utilize the reduced coenzymes for triose reduction to glycerol was unsuccessful. However, a Saccharomyces mutant, WY-57, gave good yields of glycerol in a sulfite fermentation and was found to be more resistant to sulfite poisoning. The most significant feature of the Torula yeasts were their ability to elaborate pyruvate (as much as 8 per cent of the glucose used).

Part II was a survey of naturally occurring yeasts which produce high yields of polyhydric alcohols in non-steered fermentations. Sixteen strains of the genus

Zygosaccharomyces were screened for polyhydric alcohol production in aerated fermentations. Five yeasts were chosen for further study of factors which affect the production of polyols. Outstanding yields of glycerol (35 to 45 per cent) and arabitol (30 to 40 per cent) in a 10 per cent glucose fermentation, were obtained from three yeasts - Z. nussbaumeri, Z. richteri and Z. rugosus. A culture of Z. barkeri converted 55 per cent of the glucose to arabitol.

Aeration was an important factor in increasing the yield of polyols, but glucose modified the air requirement. Low concentrations of yeast extract favored polyol production. Added phosphate reduced the yield of these products but enhanced cell growth and ethanol formation. Under the conditions studied, yields were not affected by additions of vitamins, trace elements, or amino acids.

In connection with the survey of osmophilic yeasts, strains were isolated from fresh pollen, brood comb honey, brood comb pollen and clover heads growing near a bee colony. Twenty-three isolates were screened for their glycerol producing ability. One of the cultures (identified as Torulopsis magnoliae by Dr. L. J. Wickerham, Northern Utilization Research and Development Division, Peoria, Illinois) was chosen for further studies in Part III of the work. Carbon balance determinations made on this culture showed that 93 per cent of the carbon added to the fermentation was recovered as identified products. If the carbon from products for which assumptions are justified is added, the overall recovery was 97 per cent. Glycerol, yeast cells and CO<sub>2</sub> accounted for 46.6, 12.9 and 22.9 per cent respectively of the added carbon.

The object of Part IV was the development of a synthetic medium which was adequate for cell growth and glycerol production by T. magnoliae and Z. nussbaumeri. It was found that the vitamins required for maximum growth by the former were thiamine and biotin, and those required by the latter were biotin and pyridoxine. The inorganic phosphate concentration and the nitrogen source were the most significant factors affecting the production of polyhydric alcohols. The optimal phosphate level was about 2 mM and the best nitrogen source tested was ammonium lactate.

The synthetic medium proposed contained 100 g glucose, 3.57 g ammonium lactate, 0.34 g KH<sub>2</sub>PO<sub>4</sub>, 0.50 g KCl, 0.40 g MgSO<sub>4</sub>·7H<sub>2</sub>O, 1.75 mg ZnSO<sub>4</sub>·7H<sub>2</sub>O, 1.05, mg FeSO<sub>4</sub> (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>·6H<sub>2</sub>O, 0.096 mg CuSO<sub>4</sub>·5H<sub>2</sub>O, 0.005 mg MnSO<sub>4</sub>·H<sub>2</sub>O, 0.01 mg biotin, 1.00 mg thiamin·HCl and 1.00 mg pyridoxine·HCl per liter. Fermentations of this medium by T. magnoliae gave a 47 per cent glycerol yield and by Z. nussbaumeri gave 45 per cent glycerol and 25 per cent arabitol yields. Microfilm \$2.00; Xerox \$4.40. 85 pages.

## CHARACTERISTICS OF THE NUTRITION OF ASCITES TUMOR CELLS.

(L. C. Card No. Mic 59-3257)

Joseph Franklin Henderson, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor H. P. Rusch

Two aspects of the nutrition of tumor cells have been investigated, one relating to protein nutrition, the other

to the role of exogenous purines in the nucleic acid metabolism of these cells.

The possibility, suggested previously by others, that tumor cells are able to utilize plasma protein directly or preferentially was studied by injecting glycine-2-C<sup>14</sup>, lysine-U-C<sup>14</sup>, and whole mouse plasma or plasma fractions labeled with each of these radioactive amino acids intravenously into C3H and Swiss mice bearing 6C3HED lymphosarcoma ascites cells. The distribution of radioactivity from these substances in the tumor and tissues of the mice was then determined over a period of six hours.

In C3H mice, liver, intestine and spleen incorporated relatively more free amino acid into protein than did tumor, but the lymphosarcoma cells utilized plasma protein for this process to a greater extent than did the normal tissues. When the tumor was implanted in Swiss mice, its relative incorporation of plasma protein was greater than in C3H mice.

The role of host tissue purines in the nutrition of tumor cells was also investigated. When Sarcoma 180 was implanted into mice 48 hours after injection of adenine-8-C<sup>14</sup> and allowed to grow for 7 days, the tumor had acquired significant radioactivity in the acid-soluble and nucleic acid purines.

At intervals of 3, 24 and 48 hours after the injection of adenine-8- $C^{14}$  into CAF1 mice, 5 x  $10^8$  TA3 ascites tumor cells were injected intraperitoneally into each mouse. Three and 24 hours later the tumor and host tissues were analyzed for acid-soluble and nucleic acid adenine and their specific activities determined. At every time interval, significant amounts of radioactivity had been taken up and utilized by the tumor, indicating the presence of an active mechanism for transfer of purines from host tissues to tumor.

Evidence was presented that purines may be transported among mouse tissues by blood cells. Adenine was readily taken up by blood cells in vitro. Adenine was also transferred from rat livers undergoing perfusion to blood cells. Blood cells labeled with radioactive adenine lost this adenine in vivo to mouse tissues, which incorporated it into their acid-soluble and nucleic acid fractions. That this was not due to blood cell destruction was demonstrated by labeling the blood cells with lysine-C<sup>14</sup> and showing that the blood cell protein radioactivity did not decrease at the same rate as that of the blood cell adenine.

Correlation between the biological effect of azaserine in inhibiting growth of solid tumor implants and its biochemical inhibition of de novo purine synthesis was obtained. Mice bearing solid tumors were treated with azaserine at the dose and time schedule which caused essentially complete inhibition of de novo purine synthesis for seven days. Tumor growth was inhibited only 60 to 80 per cent, reflecting the ability of the tumor to obtain its purine requirements from the diet or host tissues.

Conditions influencing de novo purine synthesis in Ehrlich carcinoma ascites cells in vitro were examined and the dependence of this process on an adequate supply of energy and of glutamine was shown.

of energy and of glutamine was shown.

Glycine-2-C<sup>14</sup> and formate-C<sup>14</sup> were compared as precursors of purines in ascites tumor cells in vitro. In the presence of glucose, relative values of incorporation expected from theory were attained. In the absence of energy supply, much more formate than glycine was incorporated into adenine. This was probably due to exchange of the number 2 carbon of the purine ring with added formate-C<sup>14</sup>. Microfilm \$2.20; Xerox \$7.60. 165 pages.

STUDIES ON THE PREPARATION
AND INFECTIVITY OF TOBACCO MOSAIC
VIRUS NUCLEIC ACID.

(L. C. Card No. Mic 58-3786)

James Andrew Lippincott, Ph.D. Washington University, 1958

Please see abstract on page 861.

Microfilm \$2.00; Xerox \$7.00. 149 pages.

CARBON DIOXIDE PRODUCTION AND SUGAR FORMATION IN THE RIPENING BANANA (MUSA CAVENDISHII).

(L. C. Card No. Mic 59-3079)

Godfrey Emile Mann, Ph.D. Louisiana State University, 1959

Supervisor: Professor William H. James

The ripening of the banana (<u>Musa cavendishii</u>) has been studied with respect to carbon dioxide production and formation of sugars. Ethylene was used to stimulate ripening, and the results obtained were compared with data from spontaneously ripened fruit. Carbon dioxide was measured with a constant-flow respirometer, and paper chromatographic methods were used to determine sugars.

Upon exposure at 68° F. to an atmosphere containing one part per thousand ethylene, the respiration intensity of the unripe banana rose rapidly from a preclimacteric value of 21 to a peak of about 140 mg. CO<sub>2</sub>/kg./hr. For the spontaneously ripened fruit the peak value was about 120 mg. CO<sub>2</sub>/kg./hr.

The elevation in sugar content generally lagged behind the rise in respiration intensity. At fairly advanced stages of ripening, maximal sugar contents of 18 to 20% (wet basis) anthrone "glucose" were obtained in the pulp. Quantitative chromatographic estimations of fructose, glucose, and sucrose in the pulp and skin revealed marked similarities between ethylene stimulated and spontaneously ripened fruit, the proportionate amounts of fructose and glucose increasing as the total sugars increased.

Besides fructose, glucose, and sucrose, two other sugars (or sugar-like substances) were noted in the pulp. One, having the chromatographic properties of maltose, appeared only in the early stages of ethylene ripening, and was not observed at all during spontaneous ripening. The other appeared in the later stages, with or without ethylene, and could not be identified with any of the known sugars available. It was non-reducing in nature, and moved relatively slowly on the chromatograms, appearing below maltose but above raffinose. Ethylene has pronounced, unexplained physiological effects upon a variety of plant organs, hence considerable interest might lie in the observation that, in this instance, it is seemingly uniquely associated with the appearance of the maltose-like component.

Microfilm \$2.00; Xerox \$6.80. 141 pages.

### MEASUREMENT OF SPECIFIC REACTION RATES WITHIN GROWING CELLS.

(L. C. Card No. Mic 59-3551)

Rusty Jay Mans, Ph.D. The University of Florida, 1959

An important problem in modern biochemistry is the relationship of enzyme activities to the metabolic processes of intact normal cells. An ideal experimental system for such studies is a culture of exponentially growing bacterial cells which can be considered as an homogeneous population throughout the course of exponential growth. The purine nucleoside metabolism of growing bacteria was chosen for study since the products of the reaction examined appear extracellularly in the growth medium. This allows the use of simple and at the same time very sensitive and precise methods to quantitatively follow the course of the reactions. Furthermore, since cell-free enzyme studies on nucleoside metabolism were under study in the laboratory, direct comparison could be made of the same activities in vitro and in vivo.

Cells of Escherichia coli strain B were grown exponentially in synthetic mineral salts media in the presence of a nucleoside. Aliquots were removed from the culture at various times and were analyzed. The number of bacteria present was determined turbidimetrically and the amount of reactant or product was determined by spectrophotometric, chromatographic, or radio-isotope procedures. The data obtained were analyzed mathematically to correct for the increase in cells and, therefore, the increase in enzyme level which occurred during the course of the experimental period. The rate of the processes could then be expressed as metabolic activity per bacterium per hour.

The addition of ribonucleosides to an exponentially growing culture of E. coli resulted in the accumulation of the intermediate products in the growth medium. Adenosine was converted to extracellular inosine by the loss of ammonia. The carbohydrate moiety was cleaved from the inosine resulting in the extracellular accumulation of hypoxanthine. Finally, the hypoxanthine was found to be taken up from the growth medium by the cells. An analogous sequence of reactions occurred when deoxyadenosine was added to a growing culture. The deamination proceeded at a constant rate (4.34 x 10-15 moles deoxyadenosine per hour per cell) independent of substrate concentration. The rate in the intact cell was comparable with that observed in extracts. However, the rate of deamination remained substantially constant down to an adenosine concentration 20,000 times less than the affinity constant for the enzyme in vitro. This result suggests that the overall process in growing cells differs significantly from the activity measured in extracts. The rate of the cleavage reaction depended on the extracellular concentration of inosine and was found to be 1/3 as fast as the deaminase reaction. The rate of the incorporation of the final product, hypoxanthine, was about 1/10 as fast as the cleavage reaction. The rate of uptake of hypoxanthine is equal to the rate of purine incorporation into the nucleic acids of growing cells. This observation is in accord with the finding that extracellular purine derivatives inhibit the de novo synthesis of purines.

It has been concluded that the adenosine deaminase activity measured in intact growing cells is associated

with a metabolic pump which accumulates substrate within the cell's permeability boundary. The methods employed here for the analysis of the data extends a method used previously for the measurement of adaptive enzyme formation and the rate of incorporation of small metabolic precursors into cellular material. This method has the singular advantage over previous methods used to study intracellular processes in that phenomena such as adaptive effects, growth stimulating effects, and growth inhibiting effects, can be detected and in many cases evaluated quantitatively. In the present work examples of each of these phenomena were found.

Microfilm \$2.00; Xerox \$5.00. 97 pages.

#### FRACTIONATION OF HIGH PHOSPHORUS CONTAINING PROTEINS OF CHICKEN BLOOD SERUM.

(L. C. Card No. Mic 59-2997)

Uma Kant Misra, Ph.D. Kansas State University, 1959

When a chicken starts egg production or a cockerel is treated with feminizing hormones, certain additional protein components appear in the blood serum of these birds, and the serum contained higher amounts of phosphorus and lipid. The inorganic phosphorus content remains at a constant level, the added phosphorus being incorporated into the nondialyzable portion of the blood sera. Two major electrophoretic components, designated as components one and six, have been observed. It has been demonstrated that a large portion of the extra phosphorus is associated with these components.

Components one and six of the laying hen and diethyl-stilbesterol-injected rooster serum have been separated from the major portion of the serum components by the combined techniques of salt fractionation, preparatory ultracentrifugation, and preparatory electrophoresis. Salt fractionation of laying hen and feminizing hormone treated cockerel serum resulted in the partial separation of components one and six. P<sup>32</sup> and lipid evaluation of the above precipitate showed its high P<sup>32</sup> activity and lipid content.

Component six of laying hen and diethylstilbesterolinjected rooster serum was separated as the top fraction by the use of preparatory ultracentrifuge and shown to be homogeneous by means of electrophoresis and the ultra-centrifuge. P<sup>32</sup> and lipid evaluation of the top fraction indicated its very high P<sup>32</sup> activity and lipid concentration. Component one was separated from the major serum protein components as precipitate I by means of preparatory ultracentrifuge and dialyzed against 0.005 molar sodium phosphate buffer, pH 7.0. P<sup>32</sup> activity associated with the electrophoretic components of precipitate I was evaluated by means of column electrophoresis. Electrophoretic peak 2 of this precipitate exhibited very high P32 activity. Component one was further separated into simpler proteins system, as precipitate II, by subjecting precipitate I to dialysis against 0.05 molar borate sulfate buffer, pH 4.5, at 7º Centigrade for 24 hours. The association of high P32 activity in the electrophoresis components of precipitate II was established by means of column electrophoresis. Electrophoretic peak 1 of precipitate II contained the highest P32 activity.

The ion exchange chromatography of precipitate I and top fraction was performed on cellulose anion exchanger (DEAE-SF). Top fraction revealed heterogeneity in ion exchange chromatography. Top fraction obtained from the cholesterol fed rooster serum by ultracentrifugation was shown to be chemically different from that obtained from laying hen and diethylstilbesterol-injected cockerel serum.

Microfilm \$3.00; Xerox \$10.20. 229 pages.

# QUINOLINE DERIVATIVES IN MAMMALIAN URINE.

(L. C. Card No. Mic 59-3219)

Jyotsna Kumar Roy, Ph.D. University of Wisconsin, 1959

Supervisor: Associate Professor James M. Price

Kynurenic acid and xanthurenic acid have been considered to be metabolically inert. However, it was demonstrated recently that kynurenic acid and xanthurenic acid were dehydroxylated by humans and rats to quinaldic acid and 8-hydroxyquinaldic acid, respectively. It was also found that human urine contained the 8-methyl ether of xanthurenic acid. Present studies concerned attempts at the isolation and identification of these quinoline compounds, chiefly in normal rabbit and pig urine. For isolation of these quinoline compounds, the urine was acidified with HCl, passed through a column of Dowex 50 (H+) and the column was then washed with 0.2N and 0.5N HCl. The quinoline compounds were eluted with large volume of water which was passed directly through a column of Dowex 1 HCOO. Some quinaldic acid and most of kynurenic acid, xanthurenic acid, 8-methyl ether of xanthurenic acid, 8hydroxyquinaldic acid, 6-hydroxykynurenic acid and quinaldylglycine were eluted under this condition. To elute the major portion of quinaldic acid, washing with additional volume of water was necessary. The quinoline compounds were adsorbed on the Dowex 1 column and were then eluted with 6N or 12N formic acid.

To separate quinoline compounds from one another as well as from other impurities, they were rechromatographed on Dowex 1 or Dowex 2 HCOO or Dowex 2 CH<sub>3</sub>COO and eluted by a gradient elution with formic acid or acetic acid. The compounds were isolated by pooling the contents of appropriate fractions and subsequent purification by paper chromatography. They were identified by the method of isolation, melting points, ultraviolet fluorescence, ultraviolet spectrums and color reactions. Quinaldic acid, 8-hydroxyquinaldic acid, 6-hydroxykynurenic acid and the 8-methyl ether of xanthurenic acid were further characterized by decarboxylation at 250-280°. The products of decarboxylation were identified by melting points or paper chromatography.

When urine obtained from normal rabbits was handled in this manner, it was possible to isolate kynurenic acid, xanthurenic acid, quinaldic acid and 8-hydroxyquinaldic acid in crystalline form. Quinaldylglycine was also identified but could not be isolated in crystalline state. The daily urinary excretion of quinaldic acid was found to be 10.4 to  $19.9~\mu$ moles per rabbit per day.

Pig urine contained kynurenic acid and xanthurenic acid as the major quinoline derivative. Small amounts of two

other quinoline compounds were found in pig urine, and identified as 6-hydroxykynurenic acid and the 8-methyl ether of xanthurenic acid.

8-Hydroxyquinaldic acid was isolated from the urine of rats fed a pyridoxine deficient diet containing 1 per cent tryptophan. 8-Hydroxyquinaldic acid was difficult to detect in normal rat urine but it was found that pyridoxine deficient rats on a tryptophan-supplemented diet excreted about 1.2-1.5  $\mu$ moles of this metabolite daily.

Some studies were carried out concerning the biosynthesis of the 8-methyl ether of xanthurenic acid. It was found previously that 3-methoxykynurenine was converted in vivo and in vitro to the 8-methyl ether of xanthurenic acid. In the present studies, it was found that formation of the 8-methyl ether of xanthurenic acid from 3-methoxykynurenine by a rat liver homogenate was stimulated by  $\alpha$ -ketoglutarate or pyridoxal phosphate and inhibited by carbonyl reagents, suggesting that the 8-methyl ether of xanthurenic acid was formed by transamination of 3-methoxykynurenine. Part of 3-methoxykynurenine was also converted to 3-methoxyanthranilic acid. Thus, the biosynthesis of 8-methyl ether of xanthurenic acid may involve 3-methoxykynurenine, although the latter has not yet been demonstrated as a natural product.

Microfilm \$2.00; Xerox \$4.80. 95 pages.

ON THE ACCESSIBILITY OF SULFHYDRYL GROUPS IN ASCORBIC ACID OXIDASE.

(L. C. Card No. Mic 59-3133)

George Robert Stark, Ph.D. Columbia University, 1959

In recent years, some workers have observed that the enzyme ascorbic acid oxidase is inhibited by organic mercurials and have therefore postulated that it is dependent upon sulfhydryl groups for its activity. The inhibition of this enzyme by p-chloromercuribenzoic acid was therefore studied. It was found that when an enormous molar excess of inhibitor to enzyme was employed, some slight inhibition could be observed. However, it was concluded that this inhibition could be explained more readily in terms of protein denaturation than sulfhydryl dependency. This conclusion was borne out when amperometric titration of the native enzyme with silver ions revealed no reactive sulfhydryl groups.

Amperometric titration of ascorbic acid oxidase which had been chemically denatured showed 10-12 sulfhydryl groups and 3-4 disulfide linkages. The quantities of protein which were titrated were smaller than any previously published. A new method for the determination of the titration end point has been developed, which is free of some possible sources of error involved in the end point determination in the titration of very small amounts of protein sulfhydryl by the previously published method.

The observation has been made that certain chemical denaturing agents free the specifically bound copper from ascorbic acid oxidase.

Quantitative amino acid determinations on ascorbic acid oxidase hydrolysates have been performed which, together with some other considerations, have yielded estimates of the quantities of the amino acids lysine,

histidine, arginine, aspartic acid, threonine, serine, glutamic acid, proline, glycine, alanine, cystine, cysteine, valine, methionine, isoleucine, leucine, tyrosine, phenylalanine and tryptophan. In addition, glucosamine has been found and estimated in ascorbic acid oxidase hydrolysates.

The presence of glucosamine has prompted the postulate that ascorbic acid oxidase may be a copper-protein-carbohydrate complex.

Microfilm \$2.00; Xerox \$4.60. 87 pages.

## STUDIES ON LOCAL LESION FORMATION BY TOBACCO MOSAIC VIRUS.

(L. C. Card No. Mic 58-3792)

Jia-Hsi Wu, Ph.D. Washington University, 1958

Please see abstract on page 865.

Microfilm \$2.00; Xerox \$5.40. 107 pages.

CHEMISTRY, INORGANIC

#### STUDIES OF THE RARE EARTH CARBONATES.

(L. C. Card No. Mic 59-3008)

Joseph Meyer Axelrod, Ph.D. University of Maryland, 1959

Supervisor: Assistant Professor Richard H. Jaquith

Carbonates of lanthanum, praseodymium, neodymium, samarium, gadolinium, a dysprosium-holmium mixture, and a holmium-erbium mixture were made by homogeneous precipitation from aqueous trichloroacetate solutions and separation factors were measured for the two mixtures. Carbonates of lanthanum and neodymium were formed by homogeneous precipitation from aqueous lanthanon nitrate solutions containing urea. The crystalline compounds formed were identified by x-ray powder diffraction and the formulae were determined by analysis.

Lanthanum, praseodymium, neodymium, and gadolinium carbonates were formed by precipitation of less than half of the lanthanon from 0.05 molar lanthanon trichloroacetate solutions at 60, 70, and 80°C. Lanthanum and praseodymium formed Ln2(CO3)3.8H2O. Neodymium, samarium, and gadolinium formed Ln<sub>2</sub>(CO<sub>3</sub>)<sub>3</sub>·2H<sub>2</sub>O. Dysprosiumholmium and holmium-erbium carbonates were formed by precipitation from 0.03 and 0.13 molar solutions at 60, 80, and 90°C. Both mixtures formed Ln2(CO3)3.2H2O and amorphous carbonates approximating Ln<sub>2</sub>OH(CO<sub>3</sub>)<sub>2,5</sub>·3H<sub>2</sub>O. Lanthanum, praseodymium, and dysprosium-holmium formed precipitates at room temperature from the stock solutions 0.21 molar in lanthanon. Lanthanum formed La<sub>2</sub>(CO<sub>3</sub>)<sub>3</sub>·8H<sub>2</sub>O, praseodymium formed a mixture of PrCO<sub>3</sub>CCl<sub>3</sub>COO · 3H<sub>2</sub>O (number of water molecules doubtful) and Pr2(CO3)3 · 8H2O, and dysprosium-holmium formed Ln<sub>2</sub>(CO<sub>3</sub>)<sub>3</sub>· 2H<sub>2</sub>O.

Lanthanum, praseodymium, neodymium, and samarium were precipitated from solutions 0.04 molar in lanthanon and 1.0 molar in ammonium trichloroacetate at 50, 60, 70, 80, and 90°C. (not all lanthanons at all temperatures). Lanthanum, praseodymium, and neodymium formed Ln<sub>2</sub> (CO<sub>3</sub>)<sub>3</sub>·8H<sub>2</sub>O, both pure and mixed with LnCO<sub>3</sub>CCl<sub>3</sub>COO·3H<sub>2</sub>O. Samarium formed Sm<sub>2</sub>(CO<sub>3</sub>)·2H<sub>2</sub>O, mixtures containing SmCO<sub>3</sub>CCl<sub>3</sub>COO·3H<sub>2</sub>O, and amorphous carbonates and carbonate-trichloroacetates. The formula of the carbonate-trichloroacetate was determined by analysis of several milligrams of clean crystals picked from the precipitate formed at room temperature from the praseodymium stock solution.

Hydrolyses of lanthanum, praseodymium, and neodymium trichloroacetate solutions were run until 19 to 100 per cent of the trichloroacetate had hydrolyzed at 50 to 100°C. (not all times or temperatures for all lanthanons). Lanthanum formed La<sub>2</sub>(CO<sub>3</sub>)<sub>3</sub>· 8H<sub>2</sub>O and dimorphs of LaOHCO<sub>3</sub> isostructural with the minerals ancylite, (RE,Sr) (OH,H<sub>2</sub>O)CO<sub>3</sub>, and bastnaesite, REFCO<sub>3</sub>. Praseodymium formed PrOHCO<sub>3</sub> isostructural with ancylite. Neodymium formed Nd<sub>2</sub>(CO<sub>3</sub>)<sub>3</sub>· 2H<sub>2</sub>O and NdOHCO<sub>3</sub> isostructural with ancylite.

Lanthanum and neodymium were precipitated from aqueous solutions of the nitrates containing urea at temperatures from 50 to 100°C. for long and short times. Lanthanum formed the same compounds as were formed on hydrolysis with equivalent trichloroacetate. Neodymium formed Nd<sub>2</sub>(CO<sub>3</sub>)<sub>3</sub>·8H<sub>2</sub>O, basic carbonate isostructural with ancylite, and amorphous carbonates.

Conditions necessary to form the bastnaesite structure were not established. Without exception, the heavier lanthanons tended to form basic carbonates and amorphous carbonates more readily than did the lighter lanthanons.

The separation factor for dysprosium-holmium varied from 1.46 at room temperature to 1.18 at 90°C., and was the same, within the error of analysis, at both concentrations. For holmium-erbium, the separation factor at 60°C. for the more concentrated solution was 1.28, but at all other temperatures and concentrations, was 1.00 within the limits of error of the analyses. The lighter lanthanon concentrated in the precipitate.

The dilute solutions of both mixtures tended to form more basic precipitates than the concentrated solutions. At 60°C., dysprosium-holmium formed normal carbonate dihydrate and holmium-erbium formed the normal carbonate dihydrate mixed with amorphous, basic carbonate. At 80°C., dysprosium-holmium formed a mixture from the concentrated solution and amorphous, basic carbonate from the dilute solution; holmium-erbium formed amorphous, basic carbonate at both concentrations. At 90°C. both mixtures formed only amorphous, basic carbonates. The most basic carbonate formed had a Ln: CO<sub>2</sub> ratio of 2:2.3. Microfilm \$2.00; Xerox \$4.40. 85 pages.

THE SUBSTITUENT EFFECT IN TRANSITION METAL COMPLEXES OF 1,10-PHENANTHROLINE.

(L. C. Card No. Mic 59-3373)

Roman Ivan Bystroff, Ph.D. Iowa State College, 1959

Supervisor: Dr. Charles V. Banks

The relative substituent effect and the stabilities of complexes of divalent transition metals with 1,10-phenanthroline were investigated. The stability constants were measured by a partition method, spectrophotometric equilibrium studies, competition with complexes of known stability, and by a titrimetric pH measurement technique. The metal ions investigated with success were Fe(II), Co(II), Ni(II), Cu(II) and Zn(II). This set provides a continuous variation in the hybrid orbital electronegativities as measured by the second ionization potential. The substituents in the 5-position of 1,10-phenanthroline which provided a continuous variation in the ligand electronegativities were NO<sub>2</sub>-, Br-, Cl-, H-, and CH<sub>3</sub>-. Only the NO<sub>2</sub>- and H- substituted ligands have been studied with all the metal ions above, however.

The step-wise  $pk_i$  values obtained were as follows: 1,10-phenanthroline: for Zn,  $pk_1 = 6.36$ ,  $pk_2 = 5.64$ ,  $pk_3 = 5.2$ ; for Cu,  $pk_1 = 9.1$ ,  $pk_2 = 6.65$ ,  $pk_3 = 5.25$ ; for Fe,  $pk_1 = 5.85$ .  $5-NO_2-1$ ,10-phenanthroline: for Zn,  $pk_1 = 5.6$ ; for Cu,  $pk_1 = 8.0$ ,  $pk_2 = 5.47$ ,  $pk_3 = 4.2$ ; for Ni,  $pk_1 = 7.0$ ,  $pk_2 = 6.4(?)$ ,  $pk_3 = 7.0$ , for Co,  $pk_1 = 6.25$ ,  $pk_2 = 5.41$ ,  $pk_3 = 4.63$ , for Fe,  $pk_1 = 5.06$ . 5-Cl-1,10-phenanthroline: for Zn,  $pk_1 = 5.85$ . 5-Br-1,10-phenanthroline: for Fe,  $pk_1 = 5.45$ ,  $pk_1k_2k_3 = 19.7$ .  $5-CH_3-1$ ,10-phenanthroline: for Fe,  $pk_1 = 6.05$ . The acid dissociation constants,  $pK_a$ , found spectrophotometrically were 3.33, 4.20, and 4.18 for the  $NO_2$ -, Br-, and Cl-substituted 1,10-phenanthrolines, respectively. All constants were measured at  $25\,^{\circ}C$  and an ionic strength of 0.1.

These constants, together with those in the literature, were used to compare relative substituent effects. It is shown that a general correlation exists between the relative substituent effects and the relative stabilities for the mono, bis, and tris complexes. The implications of this correlation are discussed qualitatively in terms of the effective electronegativities of the metals and ligands, and the changes in orbital mixing as these terms vary.

The unusual order of the overall stabilities of the tris complexes, Ni>Fe ~ Cu>Co>Zn, as compared to the usual order exhibited by the mono complexes, Zn < Cu>Ni>Co>Fe, is probably due to a decreased stability of the copper complex, because the favored square planar configuration is difficult to attain, and an increased stability of the iron complex, because of increased covalency in the diamagnetic state and the possibility of pibonding.

Microfilm \$2.15; Xerox \$7.60. 163 pages.

# SOME FACTORS INFLUENCING THE BORON-CHLORINITY RATIO OF SEA WATER.

(L C. Card No. Mic 59-3324)

James Avery Gast, Ph.D. University of Washington, 1959

Chairman: Thomas G. Thompson

Using a refined method for the determination of borates in sea water, investigations have been made of the factors contributing to the variations of the boron-chlorinity ratio of sea water.

Experimental and oceanographic data are presented to demonstrate that evaporation, precipitation, and the organic content of the sea water will influence the ratio. This data includes laboratory experiments on the evaporation of borates, oceanographic stations in the east central Pacific, northeast Pacific, and Arctic Oceans; and a thirteen month study of Puget Sound, Washington.

It is concluded that in areas where precipitation exceeds evaporation, the surface water will be boron enriched, while excess evaporation will tend to deplete the surface water of boron.

Organic matter will complex with boron to give lowered apparent boron concentrations, the resulting complex formed being oxidizable with potassium permanganate to release additional boron for analysis.

Microfilm \$2.00; Xerox \$4.60. 87 pages.

# A STUDY OF THE ALPHA PARTICLE INDUCED FISSION OF SOME ELEMENTS LIGHTER THAN POLONIUM.

(L. C. Card No. Mic 59-3340)

Edward Florian Neuzil, Ph.D. University of Washington, 1959

Chairman: A. W. Fairhall

A radiochemical study has been made of fission products from nuclear fission induced in target elements from tungsten through bismuth by bombardment with helium ions of energies between 25 and 42 Mev. Mass-yield curves were measured for 42-Mev helium-ion induced fission of Au 197, Pb<sup>204</sup>, and Pb<sup>206</sup> targets. These curves showed that fission of these species is of the symmetric type. The widths of the mass distribution curves at half the maximum yield were observed to be different for all three cases. Pb<sup>208</sup> target gave the narrowest mass-yield curve, the width at half-maximum yield being only about 22 mass units. For Pb<sup>204</sup> the corresponding width is 26 mass units, and for Au<sup>197</sup> the width is 34 mass units. Since the excitation energies of the initial compound nuclei are in the range of 35-41 Mev for these three target species, the energy for Au<sup>167</sup> target being the highest, the width of the mass distribution curve is either very sensitively dependent upon excitation energy, or else the width depends upon the nature of the target nucleus in some obscure way.

The distribution of nuclear charge which was investigated in a few cases indicated that the most probable charge-to-mass ratio of the fission fragments is not ac-

counted for by either the equal chain length hypothesis or the unchanged charge distribution hypothesis. The experimental results fell somewhere between the predictions of these two hypotheses, with somewhat closer agreement being shown by the equal chain length hypothesis. In any case the effects of charge distribution on experimental measurements of mass yields were small for the three mass-yield curves which were measured in detail. Corrections for charge distribution effects produced a slight widening of the mass-yield curve for Au<sup>197</sup>. Charge distribution effects were predicted to be appreciable for radiochemical measurements of mass distributions of fission products from target elements lighter than gold.

Excitation functions were measured for the production of the fission product Y<sup>93</sup> in targets from tungsten through bismuth bombarded with 25 to 42 Mev helium ions. These targets included also samples of enriched Pb204, Pb206, Pb<sup>207</sup>, and Pb<sup>208</sup>. From a detailed study of the energy dependence of the fission cross section, as measured by Y<sup>93</sup>, for these enriched lead targets it was possible to to determine the fraction of the observed fissions which occur before neutron emission from an initial compound nucleus, and how much occurs after the evaporation of neutrons. This competition between fission and neutron emission was also determined as a function of the excitation energy. The important result was that the probability of fission depends exponentially on excitation energy, and at any excitation energy up to at least 36 Mev about 77% of the total observed fission occurs before neutron emission, with most of the remaining fission occurring after the emission of one neutron.

The other elements behaved in a very similar way. All showed the same dependence on excitation energy, but the total probability of fission at a given excitation energy showed the expected decrease with decreasing atomic number of the target element. On examination, the total probability of fission at a given excitation energy seemed to vary exponentially with the parameter  $Z^2/A$ . Combining the energy dependence of fission ability with the dependence on  $Z^2/A$  leads to an empirical expression for the total probability of fission  $G_f$  at excitation energy E < 45 Mev for nuclides in the region from tungsten to bismuth:

$$\log G_{f}' = -6 + \frac{\frac{Z^2}{A} - 31.6}{0.6} + \frac{35 - E}{7}.$$

This expression reproduces the data within a factor of 2 or 3 over a range of  $G_f$  of the order of  $10^5$ .

Microfilm \$2.25; Xerox \$7.80. 169 pages.

PHASE EQUILIBRIUM STUDIES IN THE BINARY SYSTEM, METHYL ETHYL KETONE-WATER.

(L. C. Card No. Mic 59-3225)

Irwin Siegelman, Ph.D. University of Wisconsin, 1959

Supervisor: Professor C. H. Sorum

A complete investigation of the phase equilibrium relationships involved in the binary system of the partially miscible liquids, methyl ethyl ketone - water, has been performed. The experimental work has included definitive solid - liquid, liquid - liquid, and liquid - vapor phase equilibrium studies.

In order to determine the liquid vapor relationships the Othmer Still was employed. The liquid vapor curves show a minimum azeotrope occurring at a temperature of 73.35±0.05°C with the azeotropic composition equal to 88.45±0.15 weight percent (65.68±0.50 mole percent) methyl ethyl ketone. The liquid vapor curve intersects the miscibility gap at the invariant temperature of 73.60±0.05°C where two conjugate solution phases of composition 18.10±0.10 weight percent methyl ethyl ketone (5.23±0.50 mole percent) and 87.78±0.15 weight percent methyl ethyl ketone (64.22±0.50 mole percent) respectively are in equilibrium with a vapor phase of composition 88.00±0.15 weight percent methyl ethyl ketone (64.69±0.50 mole percent). This system, therefore, exhibits the unusual behavior of a minimum azeotrope falling outside of a miscibility gap.

For the liquid - liquid studies two general methods were employed. The thermostatic method involved the observation of the volumes occupied by ketone-rich and water-rich liquid layers in a dual analysis involving different heterogeneous mixtures of methyl ethyl ketone and water. Algebraic calculation of the composition of each of the lower and upper layers could then be made. A Cailletet-Mathias plot of the mean compositions was also made in order to determine the upper consolute temperature for the system. The synthetic method involved the determination of cloud and clear points for solutions of known composition. Results showed that this pair of liquids exhibit an upper consolute temperature of 139°C at which point the composition of the system is 44.9+0.2 weight percent (16.9±1.0 mole percent) methyl ethyl ketone. From this work, the compositions of the pair of conjugate solutions in equilibrium with ice at the invariant temperature of -6.0±0.5°C, the point of intersection of the miscibility gap and the solid - liquid diagram, were found to be 40.0±0.2 weight percent (14.3±1.0 mole percent) methyl ethyl ketone and 78.0±0.2 weight percent (47.0±1.0 mole percent) methyl ethyl ketone respectively.

In order to determine the solid - liquid phase relationships on the condensed system, the technique of thermal analysis was employed. Synthetic solutions were analyzed in a freezing point cell with determination and interpretation of breaks in time-temperature cooling curves. It was established that this system gives a binary eutectic-type diagram with pure solid components in equilibrium with the solution obtained. A eutectic point, involving these two pure components, was established at a temperature of -89.0±0.5°C with composition of the eutectic solid equal to 99.4±0.4 weight percent (98.3±0.8 mole percent) methyl ethyl ketone. The freezing point of pure, dry methyl ethyl ketone was determined to be -83.5±0.5°C.

Microfilm \$2.00; Xerox \$5.60. 113 pages.

SOME REACTIONS OF DECABORANE WITH ELECTRONS AND ELECTRON PAIR DONORS.

(L. C. Card No. Mic 59-2785)

Richard Henry Toeniskoetter, Ph.D. St. Louis University, 1958

The reaction of decaborane with sodium has been investigated in three solvents; liquid ammonia, diethylether and tetrahydrofuran. Some observations on the complex behavior of decaborane towards ammonia, both liquid and gaseous, have also been made.

The reaction of sodium with decaborane produces Na<sub>2</sub>B<sub>10</sub>H<sub>14</sub> regardless of the ratio of reactants employed. The reaction is adequately described by the equation;

$$2 Na + B_{10}H_{14} = Na_2B_{10}H_{14}$$
 (1)

Disodium tetradecahydrodecaborate,  $Na_2B_{10}H_{14}$ , is a crystalline, white solid which is soluble in ammonia and tetrahydrofuran without alteration and in water and methanol with reaction. When heated above  $150^{\circ}$ ,  $Na_2B_{10}H_{14}$  evolves hydrogen but does not melt below  $450^{\circ}$ . The infrared spectra of the compound suggests that the bridge hydrogen bonds are broken in the formation of the salt. However, decaborane can be regenerated from the compound by reaction with protic reagents showing that the structure of  $Na_2B_{10}H_{14}$  must be similar to that of decaborane.

The reaction of decaborane with sodium in diethylether or tetrahydrofuran initially yields the red  $NaB_{10}H_{14}$  which substance is unstable and either dimerizes or reacts with additional sodium. In diethylether the reaction of  $NaB_{10}H_{14}$  with sodium is slow and consequently the major part of the intermediate dimerizes and then decomposes into hydrogen and  $NaB_{10}H_{13}$ . The products,  $NaB_{10}H_{13}$  and  $Na_2B_{10}H_{14}$  are obtained in approximately nine to one ratio. The observed hydrogen and sodium stoichiometries, together with the weighed yields of the products, can be described by a suitable combination of the equations;

$$2 \text{ Na} + B_{10}H_{14} = \text{Na}_2B_{10}H_{14} \tag{2}$$

$$Na + B_{10}H_{14} = NaB_{10}H_{13} + 1/2 H_2$$
 (3)

Sodium tridecahydrodecaborate is a slightly yellow, crystalline solid which is soluble in ammonia, diehylether, tetrahydrofuran, water and methanol but insoluble in benzene and hexane. The compound does not melt but begins to lose hydrogen above 120°. The infrared spectra of NaB<sub>10</sub>H<sub>13</sub> shows the presence of bridge hydrogen atoms and chemical properties suggest that the structure of the compound must be closely related to that of decaborane.

The reaction of decaborane with sodium is more complex in tetrahydrofuran than in diethylether. In tetrahydrofuran, the products  $Na_2B_{10}H_{14}$  and  $NaB_{10}H_{13}$  are formed in about a two to one ratio but further reaction of both products takes place slowly and the final product corresponds closely to the composition  $Na_2B_{10}H_{13}$ . The chemical and physical properties of this material suggest that it may be a mixture of  $Na_2B_{10}H_{14}$  and  $Na_2B_{10}H_{12}$ .

The pressure-composition phase diagram for the decaborane-gaseous ammonia system at 0° demonstrates the formation of a hexa-, tetra-, and triammoniate of decaborane. The existence of the penta-, di-, and mono-ammoniates of decaborane are probable but less certain. The triammoniate of decaborane is an especially stable

compound and behaves like an ammonium salt rather than a coordination compound. The thermal decomposition of this substance is complex but the final product at  $120^{\circ}$  is probably  $B_{10}H_{12}(NH_2)_2$ . By rapidly heating equimolar mixtures of decaborane and ammonia to  $80^{\circ}$ , an imide is formed of composition  $B_{10}H_{12}NH$ . However, at  $25^{\circ}$  the equimolar mixture apparently reacts to produce only the triammoniate of decaborane.

When a decaborane-liquid ammonia solution is aged at  $-45^{\circ}$  and then reacted with sodium, approximately one and one-half equivalents of hydrogen are produced. Concurrent with the hydrogen production, the non-volatile reaction products retain one equivalent of nitrogen per mole of decaborane taken. Although the exact nature of the products has not been elucidated, the data obtained suggest that they are sodium derivatives of aminodecaborane, such as  $Na_2B_{10}H_{13}NH_2$ , or ammoniates of decaborane salts, e.g.,  $NaB_{10}H_{13}\cdot NH_3$ .

The evolution of hydrogen when sodium is added to aged decaborane-ammonia solutions indicates an irreversible reaction of decaborane with ammonia in solution. Revalent to this reaction it has been observed that decaborane can be recovered unchanged only from freshly prepared ammonia solutions.

Microfilm \$2.00; Xerox \$7.00. 146 pages.

### CHEMISTRY, ORGANIC

### SYNTHETICAL APPROACHES TO CHELERYTHRINE.

(Publication No. 21,737)

Aaron Leo Bluhm, Ph.D. Boston University Graduate School, 1957

Major Professor: Walter J. Gensler

Chelerythrine is a plant alkaloid of the isoquinoline group. Degradation studies have resulted in the elucidation of the structure of chelerythrine, which is now formulated as I.

Current interest in chelerythrine stems from its synergistic effect in enhancing the cancer chemotherapeutic action of colchicinamide.

This thesis describes several routes explored in an effort to synthesize chelerythrine. The synthesis was undertaken to confirm the structure, and to open a synthetic route to related compounds.

Previous work suggested that either 4-hydroxy-4-(3', 4'-methylenedioxyphenylethyl)-7,8-dimethoxyhomophthalimide, II, or 4-(3',4'-methylenedioxyphenylethyl)-7,8-dimethoxyhomophthalimide, III, would be valuable, in that their further conversion to chelerythrine appeared feasible.

Thus, homophthalimide II under the dehydrating influence of phosphorus pentoxide might be expected to lose two moles of water, and furnish the tetracyclic structure, IV. Replacement of the 1-oxo group of homophthalimides with chlorine (e.g., IV — V) has been reported. Conversion of chloride V to methosulfate salt IX is analogous to previous synthetical work. The action of  $Ag_2O$  on methosulfate IX would furnish chelerythrine, I. By a closely related sequence of reactions chelerythrine should be derivable from

homophthalimide III. Although compound II could not be prepared, compound III was eventually obtained. However, further transformation to chelerythrine met with unexpected difficulties, and the synthesis was not realized. The following paragraphs briefly sketch the experiments directed to the synthesis of II and of III, as well as the attempts to carry III further towards chelerythrine.

In an attempt to prepare homophthalimide II, the following route was investigated.

Opianic acid, X, under the influence of hydrogen peroxide furnished 3-cyano-meconin, XI, which was alkylated in the presence of triphenylmethylsodium with 3,4methylenedioxyphenylethyl iodide, XII. The alkylation product, 3-(3',4'-methylenedioxyphenylethyl)-3-cyanomeconin,

XIII, was in turn converted with alkaline hydrogen peroxide, to amide XIV, which on saponification yielded acid XV. It was not possible to convert either XIV or XV to the homophthalimide, II, by treatment with aqueous ammonia and liquid ammonia at various temperatures or by treatment with sodamide and liquid ammonia. A reductive cleavage process upon acid XV failed to give the expected di-acid, XVI, which if available, would be expected to yield homophthalimide III, with ammonia. Apparently, the stability of the lactone ring of XIV and XV was underestimated.

In order to prepare the above-mentioned alternate intermediate, 4-(3',4'-methylenedioxyphenylethyl)-7,8-dimethoxyhomophthalimide, III, three routes were investigated, of which only one succeeded.

XXIII

XXII

Opianic acid, X, was again the starting point for this preparation. Condensation of malonic acid with opianic acid furnished meconin-3-acetic acid, XVII. Compound XVII was baked with 50% potassium hydroxide. The resulting crude cinnamic acid, XVIII, on reduction with Raney alloy yielded 2-carboxy-3,4-dimethoxyphenyl-propionic acid, XIX. Pyrolysis after treatment with acetic anhydride cyclized di-acid XIX to hydrindone XX, which without purification was nitrosated to 2-nitroso-6,7-

dimethoxyhydrindone, XXI. Rearrangement with  $\rho$ -toluenesulfonyl chloride, furnished acid XXII, which was esterified
with diazomethane to 2-carbomethoxy-3,4-dimethoxyphenylacetonitrile, XXIII. The nitrile, XXIII, was then
alkylated with 3,4-methylenedioxyphenylethyl iodide, XII,
in the presence of sodamide. The condensation product,
XXIV, after saponification and treatment of the crude
saponification product with ammonia, furnished homophthalimide III.

All efforts to convert the homophthalimide, III, to the tetracyclic structure, VII, failed. Thus, attempts at cyclization by means of a hot solution of phosphorus pentoxide in phosphoric acid led to material which could not be purified. The properties of the crude product suggested that cleavage of the methylenedioxy group had occurred. Similar results were obtained with polyphosphoric acid and with concentrated sulfuric acid in glacial acetic acid. The unchanged homophthalimide, III, was recovered from a refluxing toluene solution containing phosphorus pentoxide. With hot acetic anhydride, di-acetate XXV or an isomer was formed. With hot phosphorus oxychloride, homophthalimide III furnished a compound which is tentatively formulated as XXVI.

The cyclization results were uniformly discouraging. However several methods which were not tried might have succeeded. Further work will show whether homophthalimide III is, in fact, a feasible intermediate in the synthesis of chelerythrine.

Microfilm \$3.10; Xerox \$10.60. 237 pages. Mic 59-3928.

## STUDIES TOWARD THE TOTAL SYNTHESIS OF CARYOPHYLLENE.

(L. C. Card No. Mic 59-3092)

William Henry Brown, Ph.D. Columbia University, 1959

The aldol cyclization of 2-(3'-keto-n-butyl)-2-carbethoxy-cyclopentanone has been effected with concentrated sulfuric acid to give 4-methyl-8-carbethoxy- $\Delta^{4,8}$ -hydrindan-6-one. Catalytic reduction of the double bond over palladium-on-charcoal gave the trans-hydrindanone. The ester was reduced to the alcohol and converted to the p-toluenesulfonate ester. Treatment of the tosylate with potassium t-butoxide resulted in a facile intramolecular cyclization giving largely 6-methyl-tricyclo- $\begin{bmatrix} 4 & 3 & 1 & 0^{1,5} \end{bmatrix}$ -decan-7-one and some 6-methyl-tricyclo- $\begin{bmatrix} 6 & 1 & 1 & 1 & 0^{1,5} \end{bmatrix}$ -decan-7-one. Only the former product will condense with ethyl formate, and hence the two products may be easily separated. A similar type of intramolecular cyclization has been observed to occur in the case of the p-toluenesulfonate

esters of 1-methyl-10-hydroxymethyl-2-trans-decalone

and 10-hydroxymethyl-2-cis-decalone.

1-Methyl-bicyclo-[3.1.1]-heptan-6-one and 1-methyl-bicyclo-[2.1.1]-hexan-5-one have been prepared by the potassium t-butoxide initiated intramolecular alkylation of the p-toluenesulfonate esters of 2-methyl-2-hydroxymethyl cyclohexanone and 2-methyl-2-hydroxymethyl cyclopentanone. In the cyclization of the latter compound, large amounts of t-butyl 5-methyl-5-hexenoate were also formed.

The p-toluenesulfonate ester of 2-(3'-keto-cyclohexyl)-isobutanol has been found to cyclize to give 5,5-dimethyl-bicyclo-[2.2.2]-octan-2-one. This product was in turn condensed with ethyl oxylate and oxidized with ozone to give 2,2-dimethylcyclohexane-cis-1,4-dicarboxylic-acid, which on strong heating with barium oxide was isomerized to the isomeric trans-diacid.

The internal alkylation of the p-toluenesulfonate ester of 2-(3'-keto-1'-cyclohexenyl)-isobutanol gives 8,8-dimethyl-bicyclo-[4.2.0]-oct-1-en-3-one. This appears to be the first example of  $\gamma$ -rather  $\alpha$ -alkylation of an eneone system. Microfilm \$2.00; Xerox \$4.00. 71 pages.

I. GRAFT POLYMERS DERIVED BY HIGH ENERGY RADIATION. II. PREPARATION OF ION-EXCHANGE MEMBRANES FROM GRAFT POLYMERS.

(L. C. Card No. Mic 59-925)

William K. W. Chen, Ph.D. Polytechnic Institute of Brooklyn, 1958

Adviser: R. B. Mesrobian

### PART ONE

Irradiation of a vinyl polymer by high energy radiation, such as  $\alpha$ ,  $\beta$ ,  $\gamma$ , and x-rays, has been reported to cause the formation of radical sites in the polymer. These sites may result in cross-linking or degradation of the irradiated polymer, depending on its structure. However, when a second type of vinyl monomer is present, the free radical sites can initiate its polymerization, resulting in the formation of a "graft polymer", containing trunk chains of the original polymer and branch chains of the new polymer. With the object of combining properties of two single polymers, a number of graft polymers were prepared using  $\gamma$ -rays from Co-60 sources. They were: polyethylene-styrene grafts; polyethylene-vinyl-carbazole grafts; polyethylene-vinylpyridine grafts; polytetrafluoroethylene-styrene surface grafts and vulcanized polydimethylsiloxane-acrylonitrile grafts. Some of the important properties of each of these graft polymers were studied and compared with the pure component polymers. Physical and electrical properties of polytetrafluoroethylene films irradiated by \( \gamma\)-sources, and polyethylene films irradiated in vacuo were also studied.

The rate of grafting of styrene onto polyethylene films was studied as a function of time, dose rate, film thickness and polyethylene density. Also, molecular weights of the polystyrene homopolymer fractionated from the graft polymer film, and those of the polystyrene formed in

the styrene monomer were compared. All the observed results indicated that the "Tromsdorff's Effect" was the major rate determining factor.

#### PART TWO

Graft polymer films described in Part One were used to prepare ion-exchange membranes. A series of strong cation exchange membranes was prepared by the chlorosulfonation of polyethylene-styrene grafts, followed by hydrolysis. Strong anion exchange membranes were prepared from the same type of graft polymer films by chloromethylation, followed by amination with a tertiary amine such as trimethylamine, to form quaternary ammonium groups. Y-ray induced combinations of polyethylene and polyvinylpyridine were weak anion exchange membranes. Quaternization of the polyvinylpyridine membrane with methyl iodide converted them into strong anion exchange membranes. However, it was found that the quaternized polyvinylpyridine chains were leached out by salt solutions, indicating that the original combinations were not true graft polymers but were mixtures of the two homopolymers.

The exchange capacities, degrees of swelling, electrical conductivities, permselectivities and mechanical strengths, of the polyethylene-styrene based ion-exchange membranes, were measured and correlated with polystyrene contents of the initial graft polymer films. It was found that conductivities of the ion-exchange membranes were improved by increasing initial polystyrene contents, at the sacrifice of their permselectivities and mechanical strengths. The optimum range, where the best combinations of all the properties were obtained, was at 16-20% polystyrene. The ion-exchange membranes prepared from these polyethylene-styrene graft films were found to have better conductivity and mechanical strength than the commercially available membrane studied.

These ion-exchange membranes are extreme examples of graft polymers containing chains of non-polar polymers covalently bonded to chains of polar polymers. The insolubility of these membranes in solvents for each of the component polymers is typical of graft polymers of this type.

Microfilm \$2.00; Xerox \$6.40. 134 pages.

SYNTHESIS IN THE TERPENE SERIES.

PART I. THE SYNTHESIS OF BICYCLIC PRECURSORS TO THE D-E SYSTEM OF PENTACYCLIC TRITERPENES.

PART II. THE SYNTHESIS OF EXOCYCLIC METHYLENE COMPOUNDS.

(L. C. Card No. Mic 59-3094)

Stephen Deziel Darling, Ph.D. Columbia University, 1959

Part I. The Synthesis of Bicyclic Precursors to the D-E System of Pentacyclic Triterpenes

The purpose of the present work was to study synthetic methods useful to obtain triterpenes by stereospecific total synthesis.

A proposed route to the synthesis of these pentacyclic compounds, involves an enone system which must be

reduced selectively and stereospecifically. Early experiments showed that catalytic reduction could not be used. This was supported by the slow uptake of hydrogen by  $1-(\gamma-\text{phenoxybutyl})$ , 5,8,8-trimethyl- $\Delta^{1(10)}$ -octalone-2, the lack of hydrogen uptake by  $1-(\gamma-\text{hydroxybutyl})$ , 1,5,8,8-tetramethyl- $\Delta^{9}$ -octalol-2, and the unselective uptake of hydrogen by  $1-\beta(2-\text{methylcyclohexenyl-ethyl-5,8,8-trimethyl-}\Delta^{1(10)}$ -octalone-2.

Therefore we intended to make use of a proposal by Barton and Robinson that metal-ammonia reductions give the thermodynamically most stable product.

We prepared four octalones, 5-methyl- $\Delta^{1(10)}$ -octalone-2; 5-methyl-7-methoxy- $\Delta^{1(10)}$ -octalone-2; 5 $\beta$ ,8 $\beta$ -di-methyl-7 $\beta$ -methoxy- $\Delta^{1(10)}$ -octalone-2; and 5 $\beta$ ,8 $\alpha$ -dimethyl-7 $\beta$ -methoxy- $\Delta^{1(10)}$ -octalone-2. By the use of existing data on the magnitude of 1,3 diaxial interactions, we predicted that the first and third octalones should give trans products and the remaining octalones should give cis products.

These octalones were reduced chemically and the decalol converted to the corresponding decalin and passed through a gas chromatograph column. The fractions were collected and degraded to known cis- and trans-1-methyl-cyclohexane-1,2-diacetic acids. In every case the trans product was isolated. Catalytic reduction gave mixtures in all but the last case.

We propose therefore that the product of the lithium-ammonia reduction of an  $\alpha$ ,  $\beta$ -unsaturated ketone system is determined not by thermodynamic stability of the possible products, but by the more stable of the possible intermediate anions. Because of the necessity of overlap of the carbanion and the double bond of the enolate, only one of the two possible cis forms can be considered. This, in the case of octalone reductions, is usually that corresponding to the less stable of the two cis decalones formally possible, and the result is that in most cases the trans product will be the expected one.

As further support for our findings, we found in the literature an example by Howe and McQuillin, who reduced  $epi-\alpha$ -cyperone and obtained a trans product, in spite of the fact that the cis form should be more stable.

#### Part II. The Synthesis of Exocyclic Methylene Compounds

This work was designed to introduce an exocyclic methylene group in place of a carbonyl. Although methods exist for introducing exocyclic double bonds, few are mild or generally useful.

When cyclohexanone, ethyl-2-oxocyclohexyl propionate, and ethyl-2-oxocyclohexyl acetate were treated with ketene at reduced temperatures with boron-trifluoride etherate as a catalyst, a  $\beta$ -lactone was produced which was easily pyrolized to give high yields of the exocyclic methylene compound. Microfilm \$2.00; Xerox \$4.80. 92 pages.

SUBSTITUTED ARYL-PHOSPHONIC AND PHOSPHINIC ACIDS AND RELATED COMPOUNDS AS POSSIBLE PLANT GROWTH SUBSTANCES.

(L. C. Card No. Mic 59-3031)

Joseph M. Denham, Ph.D. Ohio University, 1959

Director of Dissertation: Robert K. Ingham

In the introductory phase, a brief review of the developmental work in the field of plant growth regulation was presented. The biochemical and physico-chemical approaches to relating chemical structure to growth activity were discussed, with particular emphasis on the benzoic acid derivatives. A number of substituted aryl phosphonic and phosphinic acids and related compounds were prepared for testing as plant growth substances. Some of these compounds were also tested as gasoline additives and as antitreponemal agents. A discussion of the infrared frequency correlations for groups containing phosphorus and the role of infrared data in recent studies pertaining to the structure of phosphorous acid and its derivatives was also presented.

The phosphonic and phosphinic acids were prepared by reacting the proper benzenediazonium fluoborate compound with phosphorus tribromide in the presence of cuprous bromide and hydrolyzing the resulting mixture. Esters of several of the phosphorus compounds were prepared from the acids by the action of phosphorus pentachloride followed by treatment with ethanol. Arsonic and arsinic acids were synthesized in a manner analogous to that of the phosphorus acid preparations using arsenic trichloride in place of phosphorus tribromide. Sulfonic and sulfinic acid derivatives were prepared by several methods, most of which involved an initial reaction between the proper diazonium salt and sulfur dioxide. The following new compounds were prepared: 3,5-dichlorophenylphosphonic acid; bis(3,5-dichlorophenyl)phosphinic acid; 2,4,5-trichlorophenylphosphonic acid; bis(2,4,5trichlorophenyl)phosphinic acid; 2,3,5,6-tetrachlorophenylphosphonic acid; bis(2,3,5,6-tetrachlorophenyl)phosphinic acid; 2,6-dibromophenylphosphonic acid; bis(2,6-dibromophenyl)phosphinic acid; di-m-tolylphosphinic acid; (mbromophenyl)phenylphosphinic acid; diethyl m-chlorophenylphosphonate; ethyl bis(m-chlorophenyl)phosphinate; ethyl (m-chlorophenyl)phenylphosphinate; diethyl mbromophenylphosphonate; diethyl 2,5-dibromophenylphosphonate; m-chlorophenylphosphonous acid; bis(mbromophenyl)arsinic acid; 2,3-dichlorobenzenesulfonyl chloride; 2,3-dichlorobenzenesulfinic acid; sodium 2,3dichlorobenzenesulfonate.

Preliminary growth test results showed that there appears to be no correlation in structure-activity relationships between the benzoic acid and the phosphorus series. Among the phosphorus acids studied, the phosphinic acids appear to be superior. Results obtained to date indicate that a meta-substituted group, probably halogen, and both ortho positions open are required for maximum activity. Ester derivatives and the arsinic acid analogs appear to be inferior to the phosphinic acid compounds. No test results have been received to date for the sulfur compounds prepared.

The halogen substituted phosphorus compounds which were tested as gasoline additives appeared to have an

unfavorable effect on octane number. The compounds were not available in sufficient amounts to be tested at the customary concentration of phosphorus in the fuel, but the indications are that the compounds might then have a distinctly unfavorable effect.

As agents against Treponema pallidum, the causative agent of syphilis, certain of the polyhalogenated phosphinic acids demonstrated greater activity than any of the phosphorus compounds previously tested. Phosphinic acids appear to be superior and a degree of preference for halogen in the meta position was noted.

A study of the infrared spectra of several of the phosphonic and phosphinic acids revealed that while several correlations appear to be substantiated, additional work will be necessary before some of the correlations pro-

posed in the literature are established.

Microfilm \$2.00; Xerox \$6.80. 145 pages.

STUDIES ON THE SYNTHESIS OF HYDROXYLATED THYRONINES.

(L. C. Card No. Mic 59-3249)

Raymond Walter Doskotch, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Henry A. Lardy

The biological synergistic effect of thyroxine and epinephrine, as well as the observation that deiodination of thyroxine and 3,5,3'-triiodothyronine by liver homogenates is an aerobic process, suggested that hydroxylated thyronines such as 3'-hydroxy-3,5-diiodothyronine and 3'-hydroxy-3,5,5'-triiodothyronine might be normal metabolites in the animal body. In order to test this hypothesis it was deemed necessary to chemically synthesize these compounds. The synthesis of 3'-hydroxy-3,5-diiodo-L-thyronine has already been reported (J. Am. Chem. Soc., 80, 6230 (1958)) but it proved to be devoid of biological activity. The formation of 3'-hydroxy-3,5,5'-triiodo-L-thyronine was attempted by two routes but each failed to yield the desired product.

One method involved the condensation of 3,4-dimethoxy-5-nitrophenol with 3,5-dinitro-N-acetyl-L-tyrosine ethyl ester to give 3,5-dinitro-4-(3',4'-dimethoxy-5'-nitro-phenoxy)-N-acetyl-L-phenylalanine ethyl ester. However, replacement of the three nitro groups of this compound by iodine, to form 3,5-diiodo-4-(3',4'-dimethoxy-5'-iodophenoxy)-N-acetyl-L-phenylalanine ethyl ester, which after hydrolysis would have yielded 3'-hydroxy-3,5,3'-triiodo-L-thyronine, could not be accomplished.

The 3,4-dimethoxy-5-nitrophenol was synthesized from vanillin in seven steps. Vanillin was nitrated to 5-nitrovanillin which was methylated as the silver salt by methyl iodide to 3,4-dimethoxy-5-nitrobenzaldehyde. The oxidation of 3,4-dimethoxy-5-nitrobenzaldehyde by peracetic acid, potassium permanganate in pyridine or better silver oxide to the corresponding acid, was followed by formation of the acid chloride and treatment with ammonium hydroxide to yield 3,4-dimethoxy-5-nitrobenzamide. This amide was converted in good yields to 3,4-dimethoxy-5-nitroaniline by the Hofmann reaction. Attempts to hydrolyze the diazonium salt of this aniline derivative in aqueous

medium to the phenol failed, but decomposition in acetic anhydride followed by saponification did afford 3,4-dimethoxy-5-nitrophenol. The overall route to 3,5-dinitro-4-(3',4'-dimethoxy-5'-nitrophenoxy)-N-acetyl-L-phenylalanine ethyl ester was greatly simplified by the use of 2-methoxy-6-nitro-1,4-hydroquinone in place of 3,4-dimethoxy-5-nitrophenol.

The condensation of 2-methoxy-6-nitro-1,4-hydro-quinone with 3,5-dinitro-N-acetyl-L-tyrosine ethyl ester resulted almost exclusively in the formation of 3,5-dinitro-4-(3'-methoxy-4'-hydroxy-5'-nitrophenoxy)-N-acetyl-L-phenylalanine ethyl ester over the other possible isomer. Methylation of this condensation product with diazomethane then yielded 3,5-dinitro-4-(3',4'-dimethoxy-5'-nitro-phenoxy)-N-acetyl-L-phenylalanine ethyl ester.

The other route commenced with the condensation of 3-methoxy-4-methoxymethyloxyphenol with 3,5-dinitro-N-acetyl-L-tyrosine ethyl ester. The product, 3,5-dinitro-4-(3'-methoxy-4'-methoxymethyloxyphenoxy)-N-acetyl-L-phenylalanine ethyl ester, was converted to 3,5-dinitro-4-(3'-methoxy-4'-hydroxyphenoxy)-N-acetyl-L-phenylalanine methyl ester by treatment with acidic methanol to remove the methoxy-methyl group. The replacement of the nitro groups could not be carried out unless the phenolic group was benzoylated. The iodinated product was then 3,5-diiodo-4-(3'-methoxy-4'-benzoyloxyphenoxy)-N-acetyl-L-phenylalanine methyl ester. Upon hydrolysis 3'-methoxy-3,5-diiodo-L-thyronine was formed, but halogenation of this substance under a variety of conditions failed to yield any product.

A novel method for the synthesis of substituted hydroquinones with one desired phenolic group blocked was demonstrated in the formation of 3-methoxy-4-methoxy-methyloxyphenol. The aldehyde group of methoxymethyl-vanillin can be converted to a phenolic group by subjecting it to peracetic acid oxidation followed by saponification. The phenol was characterized as 3-methoxy-4-methoxy-methyloxyphenol on the basis that, (a) treatment in acidic methanol resulted in methoxy-1,4-hydroquinone but in aqueous medium produced exclusively a diphenylmethane derived from methoxy-1,4-hydroquinone and formalde-hyde, (b) on methylation with methyl iodide followed by subsequent hydrolysis, it yielded 2,4-dimethoxyphenol in addition to a small amount of the corresponding diphenyl-

Microfilm \$2.00; Xerox \$4.80. 91 pages.

THE STEREOCHEMISTRY AND KINETICS
OF THE CLEAVAGE OF α-PHENYLETHYL
PHENYL ETHER BY ANHYDROUS
HYDROGEN CHLORIDE.

(L. C. Card No. Mic 59-2634)

Raymond Joseph Elia, Ph.D. Michigan State University, 1957

Major Professor: Harold Hart

methane compound.

Two principal mechanisms for the cleavage of ethers by hydrogen halides have been proposed in the past; they correspond roughly to the classical  $S_N1$  and  $S_N2$  mechanisms (1) for displacement processes.

$$S_{N}^{1} \quad R-O-R' + HX \rightleftharpoons [R-O-R']^{+} + X^{-}$$

$$[R-O-R']^{+} \xrightarrow{slow} R^{+} + R'OH$$

$$R^{+} + X^{-} \xrightarrow{fast} RX$$

$$S_{N}^{2} \quad X^{-} + ROR' \xrightarrow{slow} RX + OR'$$

$$(or [ROR']^{+}) \quad (or R'OH)$$

The particular mechanism adopted by a particular ether depends on the nature of the R groups, tertiary R groups favoring the  $S_N1$  and primary or secondary R groups the  $S_N2$  path. The stereochemical consequences to be expected of these mechanisms, when the carbon atomattached to the ether oxygen is asymmetric, are racemization with some inversions for the  $S_N1$  and clean inversion for the  $S_N2$ .

Of particular interest, then, was the reported cleavage of optically active  $\alpha$ -phenylethyl phenyl ether by hydrogen chloride with retention of configuration in the  $\alpha$ -phenylethyl chloride produced (2). It was the purpose of the present investigation to examine this cleavage in more detail; in particular, a quantitative study of the kinetics and stereochemistry of the reaction appeared to be desirable. Since the experimental part of this thesis was completed, two additional examples of C-O cleavage with retention of configuration have been reported (3,4). Both were openings of epoxides in which the carbon involved had a phenyl group attached.

The kinetics of the reaction of  $\alpha$ -phenylethyl phenyl ether with hydrogen chloride in toluene, diethyl ketone, isobutyl alcohol, and absolute and 70% ethyl alcohol were followed by extracting the phenol produced and analyzing colorimetrically. The kinetics were best fit by a second order rate expression; that is, the reaction was first order each with respect to the ether and hydrogen chloride. The rate constants were relatively insensitive to solvent, though they increased slightly with increasing solvent polarity:

Solvent	k <sub>2</sub> x10 <sup>-5</sup> , 1.mol. <sup>-1</sup> sec. <sup>-1</sup> , 40°C.
toluene	1.33
diethyl ketone	2.41
isobutyl alcohol	3.18
ethyl alcohol (absolute)	3.60
ethyl alcohol (70%)	4.53

In toluene, the rate was also relatively insensitive to temperature, the Arrhenius activation energy (from 20° to 60°C) being only 3.2 kcal./mol., the entropy of activation -32.6 e.u.

The stereochemistry of the cleavage was examined in the first three solvents listed above. After suitable corrections were made for racemization of the  $\alpha$ -phenylethyl chloride during the work-up procedure, and racemization by the solvent, and by the phenol and hydrogen chloride present during the cleavage, it was established that the cleavage reaction itself proceeded with >90% retention of configuration in each solvent.

On the basis of the information presented, it is proposed that the reaction can best be represented as follows:

A rather tight ion-pair functions as an intermediate in the process.

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- (2) Hart, H. and Eleuterio, H. S., J. Am. Chem. Soc. <u>76</u>, 1379 (1954).
- (3) Wasserman, H. H. and Aubrey, N. E., J. Am. Chem. Soc. 78, 1726 (1956).
- (4) Brewster, J. H., J. Am. Chem. Soc. 78, 4061 (1956). Microfilm \$2.00; Xerox \$4.80. 94 pages.

# SYNTHESIS OF CERTAIN SUBSTITUTED PSORALENES AND RELATED COMPOUNDS.

(L. C. Card No. Mic 59-3404)

Robert Carlyle Esse, Ph.D. Oregon State College, 1959

Major Professor: Bert E. Christensen

The synthesis of a series of new 5,6-dialkyl-2,3-dihydropsoralenes is described along with the dehydrogenation of these derivatives to the corresponding psoralenes.

A compound believed to be the 6-coumaranyl ester of 2,3-dihydro-5-carboxypsoralene was prepared. This compound was dehydrogenated and also converted to the free acid. The free acid was also synthesized directly by a Pechmann type reaction. This acid was decarboxylated and dehydrogenated to psoralene. The 6-methyl homolog of 6-coumaranyl 2,3-dihydropsoralene-5-carboxylate was prepared. This compound was dehydrogenated, but could not be converted to the free acid.

An isomer of xanthotoxin, 5-methoxypsoralene, was prepared from the corresponding 2,3-dihydro derivative. 5-Acetoxypsoralene was prepared. This compound would not dehydrogenate nor did it decompose as 5-hydroxypsoralene had been reported to do under the dehydrogenation conditions used.

The synthesis of a number of coumarin derivatives which might serve as intermediates for the preparation of psoralenes was accomplished. Extensive attempts to cyclize two of these intermediates, 7-(2-oxoethoxy)-4-methylcoumarin and 7-(2-bromoethoxy)-4-methylcoumarin, were unsuccessful. In several of the cyclization experiments where a pure product was isolated it was discovered that ether cleavage to 4-methylumbelliferone rather than ring closure had taken place.

An attempted preparation of the intermediate 7-(2,3-epoxypropoxy)-4-methylcoumarin yielded a dimer of unknown structure which may possibly be the substituted dioxane, 2,5-bis-[(7-methyleneoxy)-4-methylcoumarin]-p-dioxane. Microfilm \$2.00; Xerox \$3.00. 52 pages.

PART I: THE ACIDITY FUNCTION, H<sub>0</sub>, IN ACETIC ACID-WATER MIXTURES.

PART II: A KINETIC STUDY OF THE CHROMIC ACID OXIDATION OF DIPHENYLMETHANE.

(L. C. Card No. Mic 59-3321)

Robert John Evans, Ph.D. University of Washington, 1959

Chairman: Kenneth B. Wiberg

The acidity function has been determined for perchloric acid in acetic acid-water mixtures. The data allow the calculation of  $\rm H_0$  for solutions between 0.015 and 0.300 M in perchloric acid for any acetic acid-water mixture having from 10-95% acetic acid by weight.

A kinetic study of the chromic acid oxidation of diphenylmethane has been carried out in 95 percent acidwater solvent at 30°. The rate law is

 $v = k [ \phi CH_2 \phi ] [CrO_3] h_0$ 

a kinetic isotope effect,  $k_{\rm H}/k_{\rm D}=6.4$ , was observed, and electron attracting substituents were found to decrease the rate of reaction. A Hammett  $\rho$  value of -1.40 was found. A negative salt effect was noted. The rate of reaction decreases nearly two-fold in going from 96 to 91% acetic acid. In the presence of manganous and cerous ions the rate of reaction is reduced to 1/3 to 1/2 that in their absence. These data suggest that the initial reaction is the abstraction of a hydrogen atom, forming the benzhydryl radical, which then reacts further to give the product, benzophenone.

The p-methoxy group was found to have a remarkable accelerating effect on the rate of reaction. The oxidation of p-methoxydiphenylmethane was therefore studied in some detail. Microfilm \$2.00; Xerox \$5.40. 106 pages.

DIRECTIVE EFFECTS IN ELIMINATION REACTIONS.

(L. C. Card No. Mic 59-3381)

Donald Hope Froemsdorf, Ph.D. Iowa State College, 1959

Supervisor: Charles H. DePuy

The kinetics of the base-promoted elimination of some substituted 2-phenylethyl bromides, iodides, tosylates, and sulfonium salts is reported. Good fits to the Hammett equation are obtained. The values of  $\rho$  are high  $(2^+)$ , indicating a large negative charge is built up in the transition state. It is observed that hydrogen acidity is controlling the rate of reaction. A mechanism is proposed in which a considerable amount of negative charge is developed, very little double bond formation and very little carbon heteroatom bond breaking. In one case a change in mechanism is postulated to account for the deviation of a point from the Hammett plot.

The inconsistency of the data on the direction of elimination in acetate pyrolysis, as well as the inability of present theoretical observations, prompted a reinvestigation of some simple aliphatic acetates. In all cases mixtures of products are formed from secondary and tertiary acetates. The products formed are shown to be relatively insensitive to changes in temperature and other reaction conditions. Control experiments are run to show that no isomerization, either structural or geometrical, of the products occur. The results are explained in terms of steric, thermodynamic, and statistical effects. In one instance it is shown how the ratio of products could be predicted on the basis of these considerations.

Some preliminary work on the direction of elimination in the decomposition of <u>p</u>-toluenesulfonylhydrazones is presented. It is proposed that the elimination proceeds by way of an intermediate carbonium ion. Some evidence for this proposal is discussed.

Microfilm \$2.00; Xerox \$5.40. 109 pages.

THE DIELS-ALDER REACTION OF SOME 1,1-DISUBSTITUTED BUTADIENES.

(L. C. Card No. Mic 59-3102)

Norman Lewis Goldman, Ph.D. Columbia University, 1959

The Diels-Alder reaction of several 1,1-disubstituted butadienes are described. The results are not in accord with the somewhat generally accepted idea that such dienes form polymers rather than adducts.

The first diene examined was 1,1,2-trimethylbutadiene. It was synthesized using either trimethylacrylic acid or alpha-methyl-alpha-acetylbutyrolactone as the starting material. A normal adduct was obtained with maleic anhydride as shown by degradative and nuclear magnetic resonance evidence.

The preparation of 2,5-dimethyl-1-vinylcyclopentene, 2,6-dimethyl-1-vinylcyclohexene and 1-methyl-2-vinylcy-clohexene, beginning with 2,5-dimethylcyclopentanone, 2,6-dimethylcyclohexanone and ethyl cyclohexanone-2-acetate

respectively, are detailed. All three are of interest in connection with steroid synthesis, and all three do in fact give adducts with maleic anhydride. The latter two of the group have been reported to polymerize under similar conditions.

The simplest 1,1-disubstituted diene, 1,1-dimethylbutadiene, was made from alpha-acetylbutyrolactone. The maleic anhydride adduct was produced in good yield, contrary to the experience of numerous investigators, and was shown to be the expected 3,3-dimethylcyclohexenyl derivative.

Attempts were directed towards converting the maleic anhydride adduct of 1,1,2-trimethylbutadiene into gammairone. The synthetic path required the selective reaction of the equatorial substituent of the adduct or its derivatives. No success was encountered and further efforts were not made.

The Diels-Alder reaction of 1,1-dimethylbutadiene with crotonaldehyde was tried, since the expected product should be transformable into beta-ionone. At the high temperature required for the reaction, the diene rearranged to 1,3-dimethylbutadiene and gave the corresponding adduct.

Microfilm \$2.00; Xerox \$4.60. 89 pages.

### THE STRUCTURE OF ANEMONIN.

(L. C. Card No. Mic 58-7648)

John Everett Harris, Ph.D. Brown University, 1958

Protoanemonin is a constituent of the essential oil of buttercups and other ranunculaecae where it exists as a glycoside and has been of interest because of its antibiotic activity and because of the unusual structure suggested for its dimer, anemonin. Protoanemonin was first isolated by Heyer in 1792 and was found to be very unstable in that it dimerized spontaneously to anemonin on standing. The determination of the structure of these two compounds was difficult and it was not until 1920 that Asahina designated the structure of protoanemonin as the lactone of γ-hydroxyvinylacrylic acid and anemonin as the dilactone of 1,2-dihydroxy-1,2-cyclobutanediacrylic acid. Asahina did not undertake the determination of the geometrical arrangement of the lactone rings in anemonin. His structure for anemonin has not been questioned although he never degraded the compound to any known derivative of cyclobutane and had no direct evidence for the presence of this unit in anemonin.

The dimerization of protoanemonin is also of interest in connection with the general problem of the stereochemistry of dimerizations which give cyclobutane rings. The unsaturated compounds often join head-to-tail (Type a)

rather than head-to-head (Type b) with any substituents on the olefin becoming trans on the ring. Anemonin seems to be an example of a head-to-head dimerization which causes

the substituents to be in the 1,2 positions. Some dimerizations of this type are known and the products are with few exceptions cyclobutane derivatives with substituents in a trans position to each other.

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It is the purpose of this investigation to determine the stereochemistry of anemonin and to provide supporting evidence for the structure proposed for this compound.

The catalytic reduction of anemonin with platinum gave tetrahydroanemonin which was reduced to cis-1,2-di(3-hydroxypropyl)-1,2-cyclo-butanediol (tetrol) by lithium aluminum hydride in tetrahydrofuran. Lead tetraacetate cleaved the vicinal hydroxy groups of the sodium salt of tetrahydroanemonin giving decane-4,7-dione-1,10-dioic acid (dilevulinic acid) which was identified by physical properties and by conversion to dimethyl dilevulinate. The cleavage of tetrol was accomplished with lead tetraacetate giving decane-1,10-diol-4,7-dione which was identified by infrared spectrum, analysis and by analogy with the cleavage of tetrahydroanemonin. With periodic acid, the cleavage of tetrol was complete in slightly over two hours giving the same product.

This work establishes the structure of tetrahydro-anemonin as the dilactone of cis-1,2-dihydroxy-1,2-cyclobutanedipropionic acid. Since anemonin has an infrared spectrum very similar to that of tetrahydroanemonin, the presumption that catalytic reduction has affected only the double bonds seems sound and the stereochemistry of anemonin is established. The dimerization of protoanemonin to anemonin is a head-to-head reaction with the lactones at the one and two positions on the cyclobutane ring in a cis position resulting in a meso compound.

Microfilm \$2.00; Xerox \$3.00. 53 pages.

# THE SYNTHESIS OF SOME FLUORINE-CONTAINING CYCLOBUTANES BY CYCLOALKYLATION.

(L. C. Card No. Mic 59-3548)

Robert William Johnson, Jr., Ph.D. The University of Florida, 1959

A number of fluoroölefins were added by thermal initiation to various hydrocarbon olefins and dienes. Structures have been assigned for most of the products and were based on both chemical and physical evidence including NMR spectroscopy.

A study was made of the reactions of chlorotrifluoro-ethylene, bromotrifluoroethylene, iodotrifluoroethylene, 1,1-dichlorodifluoroethylene, perfluoropropene, perfluoroacrylonitrile, 4-bromo-1,1,2-trifluoro-1-butene and 2,3-dichlorohexafluoro-2-butene with butadiene. Chloro-trifluoroethylene, bromotrifluoroethylene, iodotrifluoroethylene and 1,1-dichlorodifluoroethylene reacted with butadiene to give only the cyclobutane ring. However, perfluoropropene, perfluoroacrylonitrile and 4-bromo-1,1,2-trifluoro-1-butene reacted with butadiene to give in each case both the cyclobutane ring and the cyclohexene ring. 2,3-Dichlorohexafluoro-2-butene reacted with butadiene to give only the cyclohexene ring.

Evidence was presented for a diradical transition state for most of these cycloalkylation reactions.

Microfilm \$2.00; Xerox \$4.00. 71 pages.

A SPECTROPHOTOMETRIC INVESTIGATION OF "ARSENAZO", 3-(2-ARSONOPHENYLAZO)-4,5-DIHYDROXY-2,7-NAPHTHALENEDISULFONIC ACID AND ITS URANIUM, ALUMINUM AND CALCIUM COMPLEXES.

(L. C. Card No. Mic 59-3406)

Carl Trainer Jones, Ph.D. Oregon State College, 1959

Major Professor: Max B. Williams

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Arsenazo is a water soluble compound, which in solution, changes from a reddish-orange color at low pH values to a blue-red color at a pH of 9. It has its maximum absorbance at 500 m $\mu$  in an acid solution which shifts to 530 m $\mu$  when the pH is above 9. The compound has six replaceable hydrogens. There are two on the sulfonic acid groups which are strongly ionized. The two on the arsonic acid group have ionization constants of 5 x 10<sup>-6</sup> and 1.6 x 10<sup>-9</sup> respectively. The ionization constant for the OH radicals is much lower. For one it is 2 x 10<sup>-11</sup> and for the other less than 10<sup>-13</sup>.

The compound forms colored complexes with a number of metal ions. The ones studied are uranium, aluminum and calcium. The composition of these complexes seems to be  $M_2Az_3$ .

The uranium complex is colored blue and has a maximum absorbance at 590 m $\mu$ . The complex forms at pH values above 2 and obeys Beer's law up to about 15 p.p.m. The stability constant for the complex is approximately  $10^{-19}$ .

The aluminum complex is also blue colored, forming when the solution has a pH between 3.5 and 4. Its maximum absorbance occurs at 550 m $\mu$ .

Calcium forms a complex at pH values above 10. Its maximum absorbance is at 550 m $\mu$  and it obeys Beer's law up to 1 p.p.m. calcium. Magnesium does not complex with arsenazo and does not seem to interfere with the formation of the calcium complex.

Microfilm \$2.00; Xerox \$3.80. 66 pages.

0,0-LINKED PHENOL-FORMALDEHYDE HOMOLOGS.

(L. C. Card No. Mic 59-2984)

John Joseph Keane, Ph.D. University of Utah, 1959

Chairman: W. J. Burke

Preliminary studies demonstrated the possibility of a chromatographic separation of <u>p</u>-chlorophenol-formaldehyde homologs (Ia) on the basis of molecular weight differences. Further work indicated that use of cellulose columns and acetic acid-water elutants provided an attractive system for this purpose.

Homogeneity of the chromatographic fractions was enhanced by synthetic methods utilizing starting materials selected to give products varying considerably in molecular weight. 2,6-Bis-(hydroxymethyl)-4-chlorophenol (II), bis-(5-chloro-2-hydroxyphenyl)-methane (dimer; Ia, n=0), and 2,6-bis-(5-chloro-2-hydroxybenzyl)-4-chlorophenol

$$\begin{array}{c}
OH \\
-CH_2 \\
\hline
R
\end{array}$$

$$\begin{array}{c}
OH \\
R$$

$$\begin{array}{c}
OH \\
R
\end{array}$$

$$\begin{array}{c$$

(trimer; Ia, n=1) were used in reactions 1 through 4 as a route to the individual homologs indicated. Higher molecular weight members of the series Ia were obtained as byproducts in each instance.

dimer + 
$$CH_2O$$
  $\longrightarrow$  tetramer
dimer +  $II$   $\longrightarrow$  pentamer, octamer
trimer +  $CH_2O$   $\longrightarrow$  hexamer, nonamer
trimer +  $II$   $\longrightarrow$  heptamer

The chromatographically separated homologs were dehalogenated and acetyl derivatives were prepared of both halogenated (Ia) and dehalogenated (Ib) compounds. The products were characterized by infrared spectra, melting points, viscosity studies, cyroscopic molecular weight determinations, chromatographic assay, elemental analysis and hyperacidity titrations. The results are of particular interest in connection with the characterization of phenolformaldehyde novolacs. An evaluation of the completeness of the chromatographic separation was also made possible.

The infrared spectra of the o,o-linked phenol-formaldehyde homologs (Ib) were consistent with the presence of 2- and 2,6-substituted phenolic building units. Similarly, the spectra of the p-chlorophenol-formaldehyde series (Ia) demonstrated 2,4- and 2,4,6- substitution. As the molecular weight of a series increased, the bands associated with end groups (2- and 2,4-) tended to diminish and those associated with repeating units (2,6- and 2,4,6-) tended to absorb more strongly.

It was found that large melting point depressions resulted from small amounts of higher molecular weight impurities. Viscometric measurements and molecular weight studies gave results consistent with the proposed structures but indicated the possibility of small amounts of contamination from higher molecular weight species. The quantitative elimination of lower molecular weight products was demonstrated by chromatographic assay in both series through the heptamer. Satisfactory elemental analyses on all compounds were obtained.

It will be noted that the structure of the homologs (I) is such that intramolecular hydrogen bonding is favored. One relatively strongly acidic hydrogen was clearly demonstrated for each of the members of both homologous series through the heptamer. Such a phenomena explained the result obtained in Kunz analyses on the acetyl derivatives of the homologs. Values for acetyl content, consistently high by a factor of n+1/n where n is the number of phenolic nuclei in the polymer chain, were explained on the basis of one acidic hydrogen per molecule.

Microfilm \$2.00; Xerox \$4.80, 93 pages.

# CHEMICAL REACTIONS AND BIOLOGICAL EFFECT OF STERCULIC ACID AND ANALOGOUS FATTY ACIDS.

(L. C. Card No. Mic 59-3048)

James Carter Masson, Ph.D. University of Arizona, 1959

Supervisor: Dr. A. R. Kemmerer

Previous workers have shown that cottonseed oil or meal when fed to laying hens, produces, on cold storage, pink discoloration of eggs. Cottonseed oil is also known to give a positive Halphen test, an empirical color reaction. No other commercial oils give this test. However, sterculic acid (I), a major component of the triglycerides of Sterculia foetida oil is known to give this test. This

(I) 
$$CH_3$$
- $(CH_2)_7$ - $C$ - $C$ - $(CH_2)_7$ - $CO_2$ H

similarity led to a study of the chemical reactions and biological effect of sterculic acid.

Sterculic acid was found to cause pink egg discoloration when fed to laying hens. Dihydrosterculic acid (which does not give the Halphen test), fed under identical conditions, did not cause discoloration.

In cottonseed oil, the component giving rise to the Halphen reaction was hydrogenated, using mild conditions, before appreciable change in the iodine number of the oil had occurred.

Using urea complex formation and low temperature crystallization, the fatty acid in cottonseed oil responsible for the Halphen reaction was greatly concentrated but was not isolated. In solubility and retention time in the gas chromatograph it was very similar to linoleic acid.

The polymerization reaction of sterculic acid was found to follow a mechanism whereby the carboxyl group of one molecule opened the cyclopropene ring of another at the single bond and formed an ester. Both allyl ester and enol ester bonds were formed. The polymer formed was of relatively low molecular weight (ca. 2000); the reaction presumably stopped at this point because a secondary reaction had destroyed one of the reactants. This secondary reaction was found to be the isomerization of sterculic acid to a conjugated dienoic acid.

Microfilm \$2.00; Xerox \$3.80. 70 pages.

# THE DECOMPOSITION OF DI-t-BUTYL PEROXIDE AT ULTRA HIGH PRESSURES.

(L. C. Card No. Mic 59-3121)

Gershon Metzger, Ph.D. Columbia University, 1959

The effect of pressures up to  $7300 \text{ kg/cm}^2$  on the decomposition of di-t-butyl peroxide at  $120^0$  has been studied in four solvents. In all, the rate is depressed by pressure, and values of  $\Delta V^+$  are calculated in cc/mole as 5.44 (toluene), 7.15 (cyclohexene), 12.3 (benzene) and 13.8 (CCl<sub>4</sub>). The variation has been interpreted as arising

from the competition between recombination of t-butoxy radicals, attack on solvent (both within the solvent cage) and diffusion out of the cage.  $\Delta V^{\pm}$  for diffusion is apparently 8cc/mole. The ratio of t-butyl alcohol to acetone produced in toluene increases with pressure, with the difference in  $\Delta V^{\pm}$  for the two processes being 8.9 cc/mole.  $\Delta V^{\pm}$  for hydrogen abstraction is estimated as -3 to -6 cc/mole. In benzene toluene has been detected as a reaction product.

Microfilm \$2.00; Xerox \$3.00. 59 pages.

#### SYNTHESIS OF RESERPINE ANALOGS.

(L. C. Card No. Mic 59-3811)

Gunner Elwood Nelson, Ph.D. State University of Iowa, 1959

Chairman: Professor S. Wawzonek

A series of 1-substituted-1,2,3,4-tetrahydro-9H-pyrid (3,4-b)-indoles (I) has been prepared in which the substituent (R<sup>1</sup>) or the B-carboline nucleus has been n-propyl, n-butyl, o-tolyl and several o-carboxyaryl.

The series prepared from the several phthaldehydic acids (opianic, m-opianic, 3,4,5-trimethoxyphthaldehydic and phthaldehydic) readily undergo ring closure forming tetrahydro-5-oxo-13H-indolo(2,3-c)-isoindolo(2,1-a)-pyridines (II).

The reduction of the lactams has been attempted but was successful in only two cases ( $R^1$ ,  $R^2$ ,  $R^3$ ,  $R^4$ ,  $R^5$  = H and  $R^1$ ,  $R^2$ ,  $R^5$  = H,  $R^3$ ,  $R^4$  = OCH<sub>3</sub>). Yields for the reduction were only fair being 29.9 and 25.1% respectively.

Reduction of 1,2,3,4-tetrahydro-5-oxo-13H-indolo(2,3-c)-isoindolo(2,1-a)-pyridine-7-carboxylic acid methyl ester (III) gave only the 7-methylol derivative (IV) in 52.6% yield.

Ring closure of type I compounds (R¹ = n-propyl, n-butyl and o-tolyl) by irradiation of a solution of their 2-bromo and 2-chloro derivatives in 85% sulfuric acid was unsuccessful. A 20% yield of an amine analyzing correctly for 1-o-tolyl-3,4-dihydro-9H-pyrid (3,4-b)-indole (VI) was obtained on irradiation of a carbon tetrachloride solution of 1-o-tolyl-2-bromo-1,2,3,4-tetrahydro-9H-pyrid (3,4-b)-indole (V). A similar irradiation of 1-n-butyl-2-bromo-1,2,3,4-tetrahydro-9H-pyrid(3,4-b)-indole gave an unidentifiable product.

The dehydrogenation of 5,7,8,13b-tetrahydro-5-oxo-13H-indolo (2,3-c)-isoindolo(2,1-a)-pyridine by chloranil gave a 30% yield of 5,13b-dihydro-5-oxo-13H-indolo(2,3-c)-isoindolo(2,1-a)-pyridine (VII).

Decarboxylation of 1-o-carboxyphenyl-1,2,3,4-tetra-hydro-pyrid (3,4-b)-indole-3-carboxylic acid using copper powder and quinoline was unsuccessful as was the attempted aromatization and decarboxylation of the piperidine ring by 10% potassium dichromate and acetic acid.

The β-carbolines, lactams, reduction products and dehydrogenation product have been submitted for physiological screening as potential tranquilizing agents.

Microfilm \$2.00; Xerox \$3.60. 61 pages.

PART I: STUDIES TOWARD THE SYNTHESIS OF FULVENES, AZULENE AND PENTALENE. PART II: THE STEREOCHEMISTRY OF GIBBERELLIC, ALLOGIBBERIC AND GIBBERIC ACIDS.

(L. C. Card No. Mic 59-3123)

Howard Newman, Ph.D. Columbia University, 1959

Part I: Studies Toward the Synthesis of Fulvenes, Azulene and Pentalene.

The first part of this thesis concerns itself with the elucidation of the structure of the product obtained from the condensation of ethylorthoformate and cyclopentadiene and the investigation of its possible usefulness as a precursor for synthesizing fulvenes, azulene and pentalene.

The cyclopentadiene-ethylorthoformate adduct was shown to be 3-(diethoxy methyl)-5-ethoxy cyclopentene, which could be converted to 5-ethoxycyclopentene-3-carboxaldehyde.

A successful synthesis of phenylfulvene from the aldehyde is described, as are attempts to synthesize azulene and pentalene.

Part II: The Stereochemistry of Gibberellic, Allogibberic and Gibberic Acids.

The stereochemical configuration of gibberellic acid (I) and its acid degradation products, allogibberic acid (II) and gibberic acid (III) was investigated.

Allogibberic acid and gibberic acid were shown to have the absolute stereochemistry indicated in (IIa) and (IIIa), respectively.

The stereochemical configuration of gibberellic acid (I) was limited to the two possibilities, (Ia) and (Ib).

Microfilm \$2.00; Xerox \$4.60. 86 pages.

## CHROMATOGRAPHIC STUDIES ON GALLIC ACID SYSTEMS.

(L. C. Card No. Mic 59-3307)

Arnel Dewaine Potter, Ph.D. University of Utah, 1959

Chairman: W. J. Burke

Renewed interest in the composition of technical gallic acid solutions resulted from the recent report that certain of these preparations showed promise in the protection of cynomolgus monkeys from poliomyelities upon oral inoculation with active Mahoney Type I virus. The further observation that oxidation and aging appeared to enhance the degree of protection afforded by such preparations had made the study of oxidation and condensation products derived from gallic acid of particular interest. (L. P. Gebhardt and J. G. Bachtold, Proc. Soc. Exp. Biol. and Med., 88, 103-107 [1955]).

Study of a large number of industrial batches and several laboratory preparations of technical gallic acid, however, failed to establish a source of material of demonstrable therapeutic activity against poliomyelitis

virus in cynomologous monkeys.

In view of these results a chromatographic study was made of representative samples of technical gallic acid, including a mother liquor found promising by Gebhardt and Bachtold in earlier work. Over one hundred compounds which appeared to be possible components of Chinese gallnut fermentation were synthesized or otherwise obtained for this work.

Over three hundred developers of varying composition were investigated. Of these, fifteen were selected for characterization purposes. These fifteen were arranged in order of decreasing values for the  $R_{\rm f}$  of gallic acid in each system and assigned a number on this basis. The  $R_{\rm f}$  value of the compound in each system was plotted against the number of the system. When these points were connected, a  $R_{\rm f}$  profile was obtained. The  $R_{\rm f}$  profiles of known compounds were then compared with the  $R_{\rm f}$  profiles of unknown compounds.

A new indicator, silver nitrate in acetone, was also developed. This was found to be sensitive, versatile, and selective, in the detection of phenolic type compounds,

organic acids and sugars.

A modified two dimensional type of chromatogram was found to be useful as an aid in identification of unknowns in the complex gallic acid systems. In the first direction, the chromatogram was overloaded with respect to the major components. The  $\mathbf{R_f}$  of the minor components in the second direction were then compared with the  $\mathbf{R_f}$  values of the known components.

When four or more values of two R<sub>f</sub> profiles agreed, and there were no conflicting values, and the indicator responses were the same, the compound was considered to have been identified. On this basis, fifteen compounds, other than those previously reported in technical gallic acid, were found to be present in at least one of the fermentation or hydrolytic mother liquors which were investigated.

The products not previously reported were: oxidation and condensation products of gallic acid; purpurogallin, alpha-carboxy-beta-carboxymethyltropolone, beta-methyltropolone, citric acid, oxalic acid and flavellagic acid; the

flavones and chalcones; rutin, 3'4-methylenedioxyfisetin, morin, 2',4'-dihydroxy 3,4-methylene-dioxychalcone; and the substituted acids; 2,4-dihydroxy-benzoic acid, m-coumaric acid; m-hydroxy-benzoic acid, caffeic acid and 3,4-dimethoxycinnamic acid.

Twelve compounds were tentatively identified. Some of these had the proper indicator responses, but showed a lack of coincidence with the  $R_{\rm f}$  values of the corresponding proposed knowns in certain instances. The other compounds were considered to be only tentatively shown to be present because of the lack of  $R_{\rm f}$  values. The two or three  $R_{\rm f}$  values obtained matched with those of only one standard compound and the indicator responses were similar. Microfilm \$2.00; Xerox \$5.40. 108 pages.

#### SYNTHESIS OF 1,2-DIMETHYLENEDECALIN AND ITS USE IN THE SYNTHESIS OF ANGULAR CONDENSED POLYNUCLEAR AROMATIC HYDROCARBONS.

(L. C. Card No. Mic 59-3021)

Stephen Timothy Quigley, Ph.D. University of Maryland, 1959

Supervisor: Professor William J. Bailey

The range of known carcinogenic agents has been extended in recent years by the rapid development of the field of angular condensed polynuclear aromatic hydrocarbons. Interest in the adaptation of a known method of the synthesis of linear condensed polynuclear aromatic hydrocarbons to the synthesis of angular condensed polynuclear aromatic hydrocarbons which contained one or more "phenanthrene angles" prompted an investigation of the synthesis of 1,2-dimethylenedecalin. This compound was chosen because its Diels-Alder adducts have a built-in "phenanthrene angle."

The synthesis of 1,2-dimethylenedecalin was accomplished in a ten-step synthesis in an over-all yield of 22%. The crucial steps in the synthesis were the catalytic hydrogenation of the intermediate, diethyl 3,4-dihydro-1,2-naphthalate, with Raney nickel and nickel-on-kiesel-guhr catalysts in yields of 80% and 88%, respectively, and the pyrolysis of a diacetate in an 81% yield. The structure of 1,2-dimethylenedecalin was unequivocally proven by analysis, ultraviolet and infrared spectra, and by conversion to a known derivative through an intermediate Diels-Alder adduct. Ionic polymerization of the diene produced a white crystalline polymer which had a softening point of 102-112° and an intrinsic viscosity of 0.03.

Dibenzo [a,l] pentacene was synthesized in three steps from 1,2-dimethylenedecalin by the deoxygenation of the Diels-Alder diadduct of the diene and benzoquinone and subsequent dehydrogenation of the hydroaromatic intermediate. The crucial step in the synthesis was the dehydrogenation with 10% palladium-on-carbon in a 5% yield. The structure of the dibenzo [a,l] pentacene was indicated by analysis, ultraviolet absorption spectrum, and the formation of a crystalline Diels-Alder adduct.

Several other Diels-Alder adducts were made which may prove to be precursors of the corresponding angular condensed polynuclear aromatic hydrocarbons which contain one or two "phenanthrene angles". In addition, the aromatization of the derivative of benzo[a] pentacene was investigated.

An attempt to prepare 1,2-dimethylenetetralin by the pyrolysis of 1,2-di-(acetoxymethyl)-tetralin, prepared in a nine-step synthesis in an over-all yield of 25%, produced a hydrocarbon fraction which contained a minimum of 1% of 1,2-dimethylenetetralin. The presence of the diene was indicated by conversion to a Diels-Alder adduct, the structure of which was proven by analysis and its ultraviolet and infrared spectra.

Several derivatives of octalin, in which the position of the double bond was not ascertained, were prepared. Microfilm \$2.05; Xerox \$7.20. 155 pages.

AN APPROACH TO THE SYNTHESIS OF PIMPINELLIN AND ULTRAVIOLET ABSORPTION SPECTRA AND BENZENOID STRUCTURE.

(L. C. Card No. Mic 59-2986)

Donald Edwin Robertson, Ph.D. University of Utah, 1959

Chairman: W. James Horton

The use of  $\alpha$ -substituted acetic acids as polyphosphoric acid catalyzed acylating agents was studied. Acylations of active substrates under varied reaction conditions was attempted using glycolic, oxalic, acetoxyacetic, bromoacetic and chloroacetic acids. Only in the latter case was any  $\alpha$ -substituted acetophenone obtained. Acetoxyacetic acid was shown to behave as an acetylating agent giving good yields of the corresponding acetophenones. It is concluded that the low yields demonstrated are due to the formation of inactive complexes of the bifunctional acids, the low reactivity toward acylonium ion formation of the acids and the reactivity of the acetophenones formed.

The selective cleavage of the o-methoxyl group of methoxybenzaldehydes was studied. The preparation of 2-hydroxy-3-methoxybenzaldehyde by the selective action of hydrobromic-acetic acid was demonstrated and the catalytic effect of acetyl bromide on the reaction was studied. The use of this reagent on 2,3,4-trimethoxy-benzaldehyde was shown to give mixtures from which only small amounts of the dicleaved material could be isolated. The monocleavage of this compound was shown to require milder conditions than those reported by Reichstein. The optimum conditions for the preparation of 2-hydroxy-3,4-dimethoxybenzaldehyde were determined.

6,7-Dimethoxycoumarilic acid (VIb) was prepared and the formation of its quinone attempted. The compound was shown to be stable to quinoid oxidation and the 5-nitro derivative is reported.

An alternate approach to the synthesis of pimpinellin is proposed utilizing intermediates reported in the literature.

The empirical method for the prediction of the ultraviolet absorption spectra first suggested by Cram<sup>6</sup> and applied by Horton and Spence<sup>1</sup> has been investigated. The positions of the primary and secondary ultraviolet absorption maxima of a number of mono- and disubstituted acetophenones and benzoic acids are reported. The em-

pirical method, assuming that the displacement of the positions of band maxima in a polysubstituted parent compound from the corresponding positions for that parent compound is equal to the summation of the individual displacements caused by each substituent when substituted singly in that position of the parent, was applied to the prediction of band maxima for a number of 2,5-disubstituted acetophenones and benzoic acids. It was demonstrated that in 81.5% of the predictions made the experimental value deviated less than  $\pm$  4.5 m $\mu$  from the predicted value. The origin of the primary and secondary ultraviolet absorption bands is postulated.

The cases for which there was a significant deviation are discussed and in general ascribed to three factors:

(1) an increased steric effect in the polysubstituted compound which is not measurable in the monosubstituted parent; (2) the mutual enhancement of the bathochromic displacement effects through the para interaction of the auxochromes and (3) an inhibition in the polysubstituted compound of a factor causing a displacement effect which is measurable in the monosubstituted parent. The empirical method has been applied to a number of p-disubstituted benzenes and the deviations correlated with those found for acetophenones and benzoic acids.

The calculated and experimental maxima and their deviations for a number of acetophenones and benzoic acids which are disubstituted in other than the 2,5-positions are reported. The characteristics arising from the application of the method for each type orientation of ring disubstitution are noted.

Applications of the empirical method for the determination or identification of the arrangement of groups around the ring of disubstituted acetophenones and benzoic acids are presented. The limitations and extension of the method are discussed.

Microfilm \$2.00; Xerox \$4.80. 92 pages.

THE STEREOCHEMISTRY AND MECHANISM OF HYDROGENATION OF o-XYLENE AND ITS TETRAHYDRODERIVATIVES.

(L. C. Card No. Mic 59-3044) Gerard Vinton Smith, Ph.D. University of Arkansas, 1959

Major Professor: Samuel Siegel

The stereochemistry of the heterogeneous catalytic hydrogenation of o-xylene, 1,2-dimethylcyclohexene, 2,3-dimethylcyclohexene, and 2-methylmethylenecyclohexane was studied at different pressures of hydrogen (0.5 to 150 atms.), in different solvents (glacial acetic acid and ethanol), and on different powdered catalysts (platinic oxide, 5% platinum on alumina, 5% rhodium on alumina, 5% palladium on calcium carbonate). Some kinetic data and rate data were obtained.

The percentages of cis-1,2-dimethylcyclohexane yielded by the substrates is dependent only on the pressure of hydrogen and the catalyst. On the first three catalysts the cis product predominates, while on the latter two catalysts the trans product predominates. In the hydrogenations over platinic oxide in glacial acetic acid, an increase in the pressure of hydrogen increases the percentage of the <u>cis</u> product yielded by 1,2-dimethylcyclohexene but decreases the percentages of the <u>cis</u> product yielded by 2,3-dimethylcyclohexene and 2-methylmethylenecyclohexane. The percentage of the <u>cis</u> product yielded by o-xylene goes through a minimum as the hydrogen pressure is increased.

During hydrogenation the olefins tend to equilibrate to steady state mixtures; this equilibration is slight on platinum and large on palladium. o-Xylene yields no detectable amounts of olefins, but in an admixture with 1,2-dimethylcyclohexene, o-xylene changes the percentage of the cis product yielded by 1,2-dimethylcyclohexene as if 1,2-dimethylcyclohexene were an intermediate in the reduction of o-xylene.

Over platinic oxide in glacial acetic acid at one atmosphere of hydrogen the relative rates of hydrogenation of the substrates are as follows: o-xylene, 1.0; 1,2-dimethylcyclohexene, 4.6; 2-methylmethylenecyclohexane, 6.9; 2,3-dimethylcyclohexene, 7.3. The approximate rate expression for the olefins is zero order with respect to olefin over approximately 90% of the reaction and first order with respect to hydrogen. The rate expression for o-xylene is approximately zero order with respect to o-xylene for the early part of the reaction (10%) and first order with respect to hydrogen; the order with respect to o-xylene becomes more complicated as the reaction proceeds.

The data for the olefins can be explained in terms of one stepwise process which is similar to the "half hydrogenated state" theory. This process is the same on all metals but the rate constants for the various steps are different on different metals; the rates for the steps are altered when the metal is supported on a noncatalytic carrier.

The data indicates that o-xylene hydrogenates through a stepwise process to intermediates, two of which are identical to intermediates in the olefin hydrogenation process.

Microfilm \$2.00; Xerox \$4.60. 86 pages.

# SYNTHESIS AND REACTIONS OF SOME 2,7-DISUBSTITUTED NORBORNANES.

(L. C. Card No. Mic 59-3389)

Paul Richard Story, Ph.D. Iowa State College, 1959

Supervisor: Charles H. DePuy

This work was undertaken to provide a general route to 2,7-disubstituted norbornanes whose reactions have received relatively little investigation because of preparative difficulties. The initial step was chosen to be the Diels-Alder reaction of dimethylfulvene and an appropriate dienophile. Vinyl acetate and nitroethylene were tried unsuccessfully but  $\alpha$ -acetoxyacrylonitrile gave a good yield of the expected 2-cyano-2-acetoxy-7-isopropylidene-bicyclo-/2,2,1/-5-heptene adduct. The adduct was easily hydrolyzed to the ketone, 7-isopropylidene-bicyclo-/2,2,1/-5-heptenone-2. The UV spectrum ( $\lambda$  max. 308 m $\mu$ ,  $\varepsilon$  = 423) indicated interaction between the exocyclic double bond and the carbonyl.

Hydrogenation of the endocyclic double bond was insufficiently selective for synthetic purposes but hydrogenation of the acetate and tosylate derivatives of the endo-7-isopropylidene-bicyclo-/2,2,1/-5-heptenol-2 was 95-100% selective in hydrogenation of the endocyclic double bond. A large scale atmospheric pressure hydrogenation apparatus was developed to make the selective hydrogenation step feasible.

LiAlH<sub>4</sub> reduction of the ketone gave 90% endo alcohol which was easily isolable as a solid leaving the impure exo isomer as an oil. An investigation of hydride reductions, in general, showed, among other things, that large amounts of the exo alcohol could be obtained by aluminum isopropoxide equilibration of the endo alcohol, although the exo alcohol could not be obtained in pure form.

Ozonolysis of endo-2-acetoxy-7-isopropylidene-bicyclo-/2,2,1/-heptane proceeded in 45% yield to give the corresponding endo-2-acetoxy-bicyclo-/2,2,1/-7-heptanone (ketoacetate), which could not be hydrolyzed to the corresponding ketol but apparently suffered a retro-aldol in a very rapid reaction in base to give an uncharacterizable product. Acid hydrolysis was slower and gave a keto-aldehyde corresponding, in IR, to that expected from a reverse aldol involving ring opening.

Microfilm \$2.00; Xerox \$4.40. 82 pages.

### CHEMISTRY, PHARMACEUTICAL

## A STUDY OF THE QUASI-FAVORSKII REARRANGEMENT.

(L. C. Card No. Mic 59-3197)

Gilbert James Hite, Ph.D. University of Wisconsin, 1959

Supervisor: Associate Professor Edward E. Smissman

A novel synthesis of Demerol<sup>R</sup> (pethidine II),  $\beta$ -pethidine (III), and pethidine-type compounds has been effected pursuant to the study of the <u>quasi</u>-Favorskii rearrangement.

The sequence leading to pethidine is as follows:

#### Reaction Sequence Leading to Pethidine

a) 1 eq. NaOH,  $CH_3I_{xs}$ ; Amberlite-IRA-400 (Cl). b)  $H_2$ / PtO<sub>2</sub>-1000 psi. c)  $SOCl_2$ ; AlCl<sub>3</sub>,  $C_8H_5$ . d)  $Cl_2$ . e) NaOH, xylene. f)  $SOCl_2$ ;  $C_2H_5OH$ .

 $\beta$ -Pethidine (III) was prepared by the same sequence of reactions utilizing nicotinic acid as the starting material.

The major products isolated from the rearrangements in each case were the 1-methylbenzoylhydroxypiperidines (IV, XV). The rearrangement of (-)-1-methyl-3-benzoyl-3-chloropiperidine (VIII) with dry powdered sodium hydroxide in anhydrous refluxing xylene yielded (+)-1-

methyl-3-carboxy-3-phenylpiperidine (XIV), (+)-1-methyl-3-benzoyl-3-hydroxypiperidine (XI), which was 85-90% racemic, benzoic acid (XVII), and an unidentified amine fragment.

When the rearrangement was attempted in methanolic sodium methoxide the racemic  $\alpha$ -halogenated ketone yielded a mixture of the racemic diastereoisomeric epoxy ethers (V). With methanol free sodium methoxide in xylene VIII gave a dextrorotatory, colorless, halogen free oil which had the same infrared spectrum as V but which showed a carbonyl band at 5.97 u indicative of the formation of some  $\alpha$ -methoxy ketone (VI). No rearrangement was detected.

Optical rotatory dispersion studies indicate that VIII and XI represent the absolute configurations of the (-)- $\alpha$ -halogenated ketone and the (+)- $\alpha$ -hydroxy ketone respectively.

The rearrangement is not a semibenzilic reaction. All data on the known rearrangements of  $\alpha$ -halogenated ketones

THE MECHANISM AND THE STEREOCHEMISTRY OF THIS GUAR-SMORREIT REARRANGEMENT

containing no  $\alpha$  hydrogen can be rationalized by an ion pair mechanism similar to that shown above.

The nucleophile catalyzed, skeletal rearrangement of

 $\alpha$ -halogenated ketones possessing no  $\alpha$  hydrogen (the quasi-Favorskii rearrangement) is intermediated by ion pairs and is not stereospecific.

Microfilm \$2.00; Xerox \$5.20. 104 pages.

# A STUDY OF SOME PHYSIOLOGICALLY ACTIVE COMPONENTS OF ALFALFA.

(L. C. Card No. Mic 59-3265)

Govind Jethabhai Kapadia, Ph.D. The University of Wisconsin, 1959

Supervisor: Associate Professor Edward E. Smissman

#### Part I

A study of the isolation and purification of substances which promoted the growth of European corn borer was performed. Several methods were tried for the fractionation of these factors (CLF) from crude alfalfa concentrate (FB11). During the fractionation work, a number of samples were assayed to determine their growth promoting activity. By one of the procedures worked out, a fairly active fraction was obtained. On the basis of its activity, it was found to be fifty-five fold purified. From an ethanolic extract of a similarly prepared fraction, a white active product was isolated in small amounts. Chromatographic examination of this fraction revealed it to be a mixture. To obtain a greater amount of the active fraction for further purification, the extraction of the plant material was carried out on a large batch of alfalfa, making the necessary modifications. An active product was isolated. This was found to be a mixture by paper chromatography. Isolation of a pure active compound has not been achieved.

From the fractionation work performed, certain chemical properties were apparent. The active material was soluble in water and methanol, slightly less soluble in absolute ethanol, and insoluble in ether and anhydrous acetone. It was soluble in 50% acetone. Major portion of the active material was found to be dialyzable. It was adsorbed on anion exchanger amberlite IRA 400 (OH) and not adsorbed on cation exchanger amberlite IR 120 (H). This revealed that the active material was acidic and not a basic or an amphoteric substance. However, it could not be extracted from an aqueous solution at an acid pH with ether or a hydroxylated solvent such as n-butanol. It was not possible to isolate a product in the form of its calcium salt from a methanolic extract.

### Part II

During the fractionation of CLF from alfalfa concentrate (FB11), a yellow brown material was isolated from an inactive fraction. This was found to inhibit the growth of Penicillium chrysogenum to a certain extent. Chemical studies revealed the presence of water-soluble phenolic compounds, saponins, and reducing sugars. Attempts were made to isolate the phenolic compounds. In a procedure followed, cellulose anion exchanger was used. It was found that some phenolic compounds could not be eluted from this anion exchanger by following normal

procedures. A complex formation was involved in their adsorption. Other experimental evidence substantiated the formation of a complex. A technique was developed to obtain these phenolic materials by decomposing the complex. The fraction isolated was found to inhibit the growth of Penicillium chrysogenum. In an attempt to obtain pure products, two very closely related polyhydroxy phenolic substances were isolated by preparative chromatographic technique, however, these needed further purification.

Microfilm \$2.20; Xerox \$7.60. 165 pages.

## A STUDY OF THE COMPLEXING BEHAVIOR OF SARCOSINE ANHYDRIDE.

(L. C. Card No. Mic 59-3216)

John William Poole, Ph.D. University of Wisconsin, 1959

Supervisor: Professor Takeru Higuchi

An investigation has been made on the ability of sarcosine anhydride to form molecular complexes in aqueous solution with a series of organic compounds. The primary purpose of this study was not to demonstrate the existence of new complexes, but rather to note the effect of various polar groups and their molecular positions on the binding tendencies of the compounds as a means to further elucidate the structural requirements favoring these interactions.

The extent and nature of the interactions between sarcosine anhydride and a series of aromatic carboxylic acids, various aromatic alcohols and phenols, the isomeric xylylene glycols, a group of aliphatic dicarboxylic acids, and a miscellaneous group of other polar compounds were demonstrated by means of solubility studies. Phase diagrams were obtained by noting the effect of varying concentrations of sarcosine anhydride on the water solubility of the electrophilic substance in solution.

The solubility curves showed that both soluble and insoluble molecular complexes were formed by these interactions. The stoichiometric ratios of the insoluble reaction products were determined by analysis of the phase diagrams and chemical analysis. Apparent stability constants were calculated for the soluble complexes formed by use of equation 1.

$$K_n = \frac{(A_n B)}{(A)^n (B)}$$
 (1)

A comparison of the binding tendencies of the substances in an isomeric series of compounds shows that the position of the polar group in a molecule is important as well as the nature of the groups. The most stable complexes were obtained in those cases where the electrophilic groups of the donor compound were capable of making a two point attachment with the nucleophilic groups of the complexing agent.

The results observed with the aliphatic dicarboxylic acids indicate that the presence of an aromatic structure in one of the reactants is necessary for the formation of a stable complex.

A comparison of the complexing tendencies of the

electrophilic substances indicates that the compounds with greater hydrophobic character show greater complexing activity than the more soluble substances. This correlation can be attributed to the increased influence of the "squeezing out" effect with the less soluble materials and the stronger solute - solvent interactions encountered with the more water soluble donor compounds. Even with comparatively soluble compounds, however, relatively stable complexes can be formed if the steric relationships are favorable.

Further investigations on the nature of molecular complexes are necessary to definitely establish the nature of the attractive forces and the points of attachment of the interacting molecules. When these questions are answered it may be possible, by the use of "tailor made" complexing agents, to form complexes with any physical properties which may be required for a particular purpose. Some possible applications would include the use of complexing agents as solubilizers and stabilizers in pharmaceutical formulations or in the isolation and purification of closely related compounds.

Microfilm \$2.00; Xerox \$5.60. 111 pages.

## NON-OXIDATIVE DEGRADATION OF EPINEPHRINE.

(L. C. Card No. Mic 59-3223)

Louis Clarence Schroeter, Ph.D. University of Wisconsin, 1959

Supervisor: Professor Takeru Higuchi

The kinetics of non-oxidative degradation of epinephrine, a hormone extracted from the medullary portion of adrenal glands or prepared synthetically, has been investigated under experimental conditions simulating those existant in its common liquid dosage forms. The present study represents an integrated chemical kinetic investigation of those routes of chemical deterioration of this pharmaceutically important compound which are not induced by oxygen.

From practical standpoints there are only two of these reactions which are important. The drug contains an asymmetric center which undergoes isomerization to yield a less active racemic mixture at a significant rate. In addition to the racemization route epinephrine reacts significantly with the antioxidant, bisulfite, which is normally added to solutions of the drug. In this investigation an attempt has been made to determine the factors influencing these reactions and the probable mechanisms responsible for them.

The acid-catalyzed racemization of epinephrine was found experimentally, to follow the first order law with respect to the substrate as expected, the rate increasing very nearly directly with free hydrogen ion concentration. Optical activity under isothermal, isohydric conditions was described by the expression  $a = a_0 e^{-2kt}$  where a is the rotation at any time t and  $a_0$  is the initial rotation. The value 2k corresponds to the experimentally determined rate constant.

The mechanism of acid-catalyzed racemization appears to be of such a type to suggest a Sn<sub>1</sub> reaction in which water

does not stoichiometrically enter into the reaction. The carbonium ion never seems to be completely free from the influence of the leaving water molecule and a shielding effect appears to occur so that the incoming water molecule probably enters from the opposite side to give a Walden inversion effect. The apparent heat of activation for the process is 23.2 Kcal mole-1.

Degradation of epinephrine solutions buffered between pH 4 and 7 and stored in an oxygen-free atmosphere in the presence of bisulfite occurs at faster rates than in complete absence of bisulfite. The isolated product and the stoichiometry of the reaction indicate the following overall reaction:

$$HO HO HO-$$

1-Epinephrine

Racemic Product

The mechanism appears to involve reaction of sulfite directly with epinephrine and with an activated complex undergoing racemization reaction. All the observed facts can be explained satisfactorily by the following proposed mechanism:

(I) 
$$-d(Ep)/dt = k_4(Ep) (SO_3^-) + k_3(SO_3^-) (Ep^*)$$

(II) 
$$d(Ep^*)/dt = k_1(Ep) - (Ep^*)/k_2 + k_3(SO_3^-)/ = 0$$

(III) 
$$-d(Ep)/dt = k_4(Ep) (SO_3^{-}) + k_3 (SO_3^{-}) k_1(Ep)/k_2 + k_3 (SO_3^{-})$$

At pH values above 5 the reaction responsible for loss of epinephrine through interaction with bisulfite appears to be a simple Sn<sub>2</sub> reaction involving direct attack of sulfite ion on the catecholamine (k<sub>4</sub>) This reaction has an apparent heat of activation of 24 Kcal mole<sup>-1</sup>.

Below pH 5 there appears to be a parallel Sn<sub>1</sub> reaction (k<sub>3</sub>) occurring in addition to the bimolecular reaction. This reaction has been shown to involve the same activated intermediate responsible for racemization of epinephrine (Ep\*) and exhibits zero order dependency on bisulfite or sulfite concentration. The rate expression developed from the data has been found to closely approximate the observed pH profile of the epinephrine-bisulfite system.

Studies on the reaction of bisulfite with sympathomimetic and other drugs indicate that those compounds which are ortho or para hydroxybenzyl alcohol derivatives react with bisulfite to yield corresponding sulfonic acid derivatives. Both amino and nitrobenzyl alcohols similarly conjugated (e.g., chloramphenicol) also appear to be subject to similar reactions.

Microfilm \$2.00; Xerox \$6.00. 122 pages.

STABILITY OF MORPHINE IN AQUEOUS SOLUTION.

(L. C. Card No. Mic 59-3827)

Shu-Yuan Yeh, Ph.D. State University of Iowa, 1959

Chairman: Associate Professor John L. Lach

The kinetics of the stability of morphine in aqueous solution, and the formation of a stable morphine preparation has been studied. Data obtained in this investigation concerning the stability indicated that the degradation of morphine is dependent on the oxygen concentration, and pH of the solution. The mechanism of this decomposition is believed to involve a free radical reaction since no decomposition of morphine was observed in systems containing no oxygen. Since the undissociated (free base) and protonated species of morphine were the principal species involved in the degradation reaction, the rate was found to be pH dependent, that is, the hydrogen ion concentration of the system governed the relative amounts of both present.

A detailed discussion of the postulated mechanism concerning the degradation of morphine, the formation of pseudomorphine and morphine N-oxide and the degradation of the latter two has been presented. Based on this postulated mechanism, the following rate expression for the decomposition of morphine in solution was derived:

 $-d(Morphine)_{\mbox{total}}/dt = 3k_1(O_2)(Morphine\ \mbox{base}) + \ 3k_2(O_2)(\mbox{protonated\ morphine})$ 

or:

$$-d(Morphine)_{total}/dt = \left[3k_1(O_2)\left(\frac{K_a}{K_a+H^+}\right) + 3k_2(O_2)\left(\frac{H^+}{K_a+H^+}\right)\right](Morphine)_{total}$$

The apparent heat of activation energy was calculated and found to be 22.8 Kcal. Calculation of the frequency factor and activated entropy were found to be 1x10<sup>11</sup> hour-1 and -10.5 E.U. respectively at pH 5.0 and in excess oxygen.

In the case of the kinetics study, it was necessary to modify the chromatographic procedure of Lach et al. (42), for the separation of morphine from its degradation product. The method developed was based on a critical study of the pH of the internal phase, the quantity of support used, and the polarity of the eluent.

In the study of the formulation of a stable morphine solution involving the use of antioxidants, inhibitors, complexing agents, and various organic acids, it was confirmed that sodium bisulfite is an excellent stabilizing agent. The stability of these morphine formulations was found to be a function of the concentration of sodium bisulfite used. Further studies revealed that in addition to its role as an antioxidant, sodium bisulfite undergoes addition formation with morphine. This addition compound was isolated and chemical analysis gave a 1:1 molar ratio of morphine and sodium bisulfite. A detailed discussion concerning the theory of formation and preparation has been presented.

Microfilm \$2.00; Xerox \$5.60. 114 pages.

#### CHEMISTRY, PHYSICAL

POLAROGRAPHIC STUDIES OF SOME ORGANO-TIN COMPOUNDS IN ANHYDROUS N,N'DIMETHYLFORMAMIDE.

(L. C. Card No. Mic 59-2655)

Roger Baker Allen, Ph.D. University of New Hampshire, 1959

N,N'dimethylformamide was found to be a poor solvent for most organo-tin compounds due to the reaction with the small amount of water which remained in the dimethylformamide after distillation.

The potential of the quiet mercury pool in contact with 0.1M tetra n-butyl ammonium perchlorate solution was found to be constant if the total current flow through the cell was small. With high current flow the anode reaction appeared to change.

The organo-tin compounds used in this study were: dibutyltin diacetate, dibutyltin dilaurate, dibutyltin maleate, dibutyltin oxide, dibutyltin sulfide, tetrabutyltin, tetraphenyltin, tributyltin acetate, tributyltin oxide, dimethyltin dichloride, tributyltin chloride, trimethyltin chloride, triphenyltin chloride, phenyltin trichloride, dibutyltin dichloride, diphenyltin dichloride, 5,5-dichloro-10,11-dihydrodibenzo(b,f)-stanniepin, and tetraphenylditin dichloride.

Triphenyltin chloride, dimethyltin dichloride and 5,5-dichloro-10,11-dihydrodibenzo(b,f)stanniepin were the only three compounds which exhibited two distinguishable reduction waves.

The first reduction step has been postulated to be a one electron change. The electrode reactions being:

The second reduction step has been postulated to be a two electron change. The electrode reactions being:

$$R_3SnCl + 2e \longrightarrow R_2Sn + R \cdot + Cl^-$$
  
 $R_2SnCl_2 + 2e \longrightarrow R_2Sn + 2Cl^-$ 

A reaction of the dichlorides, with the exception of dimethyltin dichloride, and the trichlorides with the residual water in the dimethylformamide produced hydrogen chloride which obscured any reduction wave in the potential range -1.0 to -2.8 volts due to the hydrogen chloride reduction.

A similar reaction was noted with the acetates and the maleate but the interfering waves were observed at potentials of -1.9 and -2.0 volts respectively.

All reduction waves gave electron changes of less than one, except for diphenyltin dichloride and dibutyltin maleate, which indicated the reactions were irreversible.

Microfilm \$2.00; Xerox \$3.80. 70 pages.

# INFRARED SPECTRA OF SINGLE CRYSTALS OF ALLENE.

(L. C. Card No. Mic 59-3089)

Joseph Blanc, Ph.D. Columbia University, 1959

Thin single crystals of allene (propadiene) were grown from the vapor phase in an apparatus constructed to permit spectroscopic observations in the infrared region. Spectra were recorded with the incident radiation polarized along extinction directions of the crystal; these directions were determined to be major crystallographic axes of the crystal. The observations were repeated at 95°K and 125°K, and just above the melting point of the crystal (137°K).

An analysis of the behavior of the polarization properties of fundamental vibrations as well as of readily identifiable combinations leads to the conclusion that the molecules are situated at sites of trivial symmetry in an orthorhombic crystal. However, gross polarization effects indicate that the crystal can be described as being "almost tetragonal" with molecules at sites  $S_4$ . From this, it is deduced by a plausibility argument that the space-group of the allene crystal is one of several possible  $C_{2v}$  space-groups.

In addition to absorptions due to fundamentals and combinations between them, several weaker bands appear that can be ascribed only to combinations between lattice modes and fundamental vibrations. It has been possible to examine the origin of these modes in a consistent manner.

The frequency of the lattice modes has been found to vary sharply with temperatures (of the order of 10%) in the range examined, and this is interpreted as inferring considerable relaxation of restraints on the external modes of motion of the molecule near the melting point. It is not unlikely therefore that the course of the heat capacity curve will exhibit a "pre-melting" phenomenon when these thermodynamic measurements are made.

Microfilm \$2.00; Xerox \$3.60. 61 pages.

STUDIES OF MALATE SALTS: BASE CATALYZED DEHYDRATION AND PROTON MAGNETIC RESONANCE.

(L. C. Card No. Mic 59-3250)

Luther Eugene Erickson, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Robert A. Alberty

Thermodynamic and kinetic data were presented for the reversible, NaOH-catalyzed hydration of fumarate to D,L-malate in aqueous solutions from 90-175°. The thermodynamic data obtained ( $K_{eq}$ ,  $\Delta F^{o}$ , and  $\Delta H^{o}$ ) were correlated with corresponding data for the HCl-catalyzed hydration of fumaric acid to D,L-malic acid and for the fumarase-catalyzed hydration of fumarate to L-malate. The reaction was shown to follow a reversible, first-order rate law in fumarate and malate, with the rates being proportional to NaOH concentration at constant ionic

strength. The rate of L-malate racemization, catalyzed by NaOH, was found to be equal to the rate of dehydration of D, L-malate under the same conditions. Proton magnetic resonance was used to show: (a) that methylene protons of malate exchange with deuterons in D<sub>2</sub>O more rapidly than can be accounted for by successive dehydration of malate and hydration of fumarate; and (b) that both cis and trans addition of D<sub>2</sub>O occur in the hydration of fumarate. A mechanism was presented consistent with the observed kinetics.

The high resolution proton magnetic resonance spectra of malic anhydride and monodeutero-malic anhydride, the latter prepared from the monodeutero-L-malic acid resulting from fumarase-catalyzed addition of  $D_2O$  to fumarate, were analyzed to determine the chemical shifts and spin-spin coupling constants. The spin-spin coupling constants were compared with those of isocitric and alloisocitric lactone to provide evidence that the fumarase-catalyzed hydration of fumarate to L-malate occurs via a trans addition of  $H_2O$ .

In the proton magnetic resonance spectra of the five alkali metal malates significant concentration and salt effects on chemical shifts and spin-spin coupling constants were observed for the three protons bound to carbon. These effects were attributed, in part, to a change in relative populations of the possible rotational conformations, independent of the cation.

In addition, a general decrease of all chemical shifts with increased concentration was observed. This effect was smallest for dilithium malate and increased in a regular manner to a maximum for dicesium malate.

Analysis of the proton magnetic resonance spectra of partially deuterated malic acids and their salts (in  $D_2O$  solutions) gave evidence for deuterium isotope effects on proton chemical shifts and proton-proton spin-spin coupling constants for the remaining protons. In general, substitution of deuterium increases the chemical shifts of the remaining protons by about 0.1 - 0.5 cps at 40 Mc and changes coupling constants by 0.1 - 0.3 cps.

Microfilm \$2.00; Xerox \$5.20. 103 pages.

FLASH PHOTOLYSIS STUDIES OF THE RECOMBINATION OF BROMINE ATOMS.

(L. C. Card No. Mic 59-2769)

William Geary Givens, Jr., Ph.D. The University of Wisconsin, 1959

Supervisor: Professor John E. Willard

Previous determinations of the rate constants for the recombination of bromine atoms produced from Br<sub>2</sub> by flash photolysis have not allowed an independent evaluation of the "third body" effectiveness of the different gases (Br<sub>2</sub> and Ar) in the reaction mixture. Analogous studies of iodine have, however, shown that I<sub>2</sub> is several hundred times as effective as Ar as a "third body" in the I atom recombination at room temperature. In the present work the recombination rates of Br atoms have been measured at (Br<sub>2</sub>/Ar) ratios from 0.004 to 0.06 and at temperatures from 0° C. to 145° C., in order to evaluate separately the rate constants and activation energies for the reactions:

$$2Br + Ar = Br_2 + Ar \tag{1}$$

and 
$$2Br + Br_2 = 2Br_2$$
. (2)

The values of the rate constants found at  $27^{\circ}$  C. are:  $k_{Ar} = 2.0 \cdot 10^{\circ}$  and  $k_{Br_2} = 2.6 \cdot 10^{11}$   $1^2$ mole<sup>-2</sup>sec<sup>-1</sup>, for reactions 1 and 2 respectively. In addition  $k_{CO_2}$  at  $27^{\circ}$  C. was found to be  $7.8 \cdot 10^{\circ}$   $1^2$ mole<sup>-2</sup>sec<sup>-1</sup>. The apparent activation energies for recombination in Ar, Br<sub>2</sub> and CO<sub>2</sub> over the temperatures studied all lie within the range -1.5 to -2.2 Kcal/mole.

By combining data obtained at high temperatures from shock tube experiments with the flash photolysis data, the following equations were obtained which represent the recombination data satisfactorily from 273° K. to 2000° K.

$$k_{Ar} = 1.9 \cdot 10^8 \exp(1410/RT)$$

or 
$$1.2 \cdot 10^5 \text{ T}^{1/2} \left(\frac{E_0}{RT}\right)^{1.56} 1^2 \text{mole}^{-2} \text{sec}^{-1}$$

$$k_{Br_2} = 3.0 \cdot 10^8 \exp(4130/RT)$$

or 
$$5.2 \cdot 10^2 \text{ T}^{1/2} \left(\frac{E_0}{RT}\right)^{3.96} 1^2 \text{mole}^{-2} \text{sec}^{-1}$$

Eo is the bromine dissociation energy, 45.5 Kcal/mole.

The experiments utilized a flash lamp which discharged 40 to 1000 joules and gave a very intense short pulse of light which dissociated several per cent of the bromine in the reaction cell. Recombination was followed by a monochromatic analyzing beam which passed through the cell and was monitored with a photomultiplier tube. Observation was with an oscilloscope-chart recorder combination. The oscilloscope traces were recorded photographically.

Thermal effects due to temperature rises in the cell caused by the absorption of energy from the flash and subsequent cooling were observed to be in approximate agreement with calculated effects. Corrections for these effects were necessary in cases where the  $(Br_2)/(Ar)$  ratio was greater than 0.01.

Microfilm \$2.00; Xerox \$5.80. 119 pages.

KINETICS OF THE EXCHANGE OF PHOSPHORUS IN PCl<sub>3</sub>-POCl<sub>3</sub> SYSTEMS: EFFECT OF GAMMA RADIATION, ULTRAVIOLET LIGHT, VISIBLE LIGHT, HEAT AND TRACES OF WATER.

(L. C. Card No. Mic 59-2995)

LeRoy Francis Grantham, Ph.D. Kansas State University, 1959

The exchange of phosphorus in PCl<sub>3</sub>-POCl<sub>3</sub> systems has been measured with the aid of phosphorus-32 radio-active tracer. Mixtures (5 ml) containing from 2.1 to 99.5 mole percent PCl<sub>3</sub> were sealed in quartz ampoules. After irradiation the mixtures together with added carriers were separated by distillation. Aliquots of the distillate fractions were diluted with xylene and radioassayed in a Geiger dipping counter arrangement.

Samples were subjected to gamma radiations at a flux varying from  $9 \times 10^3$  to  $4 \times 10^4$  rads min<sup>-1</sup> for different lengths of time. The total dosage received varied from

 $7.6 \times 10^7$  to  $3.4 \times 10^8$  rads. An induced exchange was found to obey the equation where M is the millimoles of phosphorus exchanged per gram

M = k'bD - k''abD

of solution, a and b are concentrations of PCl<sub>3</sub> and POCl<sub>3</sub> per gram of solution respectively, and D is the dosage in rads. The values of the constants, k' and k", were found to be (3.19-0.16) x 10<sup>-10</sup> rads<sup>-1</sup> and (4.24-0.31) x 10<sup>-11</sup> g millimoles - rad-1 respectively. From 0.017 to 2.5 atoms of phosphorus exchanged per 100 ev of energy absorbed. The amount of exchange appeared to be independent of radiation intensity or energy but was first order in total dosage received by the sample.

A mechanism of exchange was proposed based on the dissociation of the P-O bond and subsequent recombination of the oxygen with PCl<sub>3</sub> in the solution. Additional mechanisms were suggested which involved the gamma ray induced transfer of oxygen in a bimolecular process or the gamma ray induced transfer of oxygen between weakly coupled POCl<sub>3</sub>-PCl<sub>3</sub> dipoles.

No phosphorus exchange was observed for PCl<sub>3</sub>-POCl<sub>3</sub> mixtures kept at room temperature. Little or no exchange was found for samples held at 250° C for periods up to 23 days in the presence or absence of white light. Traces of water in the mixtures increased the rate of exchange. A detectable amount of exchange was induced by ultraviolet light.

Microfilm \$2.00; Xerox \$4.00. 75 pages.

STUDIES OF ENZYME KINETICS: DIFFUSION CONTROLLED REACTIONS AND RELAXATION SPECTRA.

(L. C. Card No. Mic 59-3252)

Gordon G. Hammes, Ph.D. University of Wisconsin, 1959

Supervisor: Professor Robert A. Alberty

A theory is proposed for calculating the diffusion controlled rate of formation of enzyme-substrate complexes. Although a rigorous solution to this problem, including electrostatic effects, is not possible, good agreement between experimental results for the fumarase reaction and theory is obtained using simple models. If the effect of the net protein charge is neglected, the rate of reaction can be calculated by considering the rate of diffusion of substrate into a hemispherical site on the enzyme. Charge interactions between the site and substrate can be taken into account assuming either a simple coulombic or Debye-Huckel potential. When the net protein charge is included in the model, an analytical solution of the problem cannot be obtained, but by considering "average" potentials numerical solutions have been obtained for several cases through use of a computer. The minimum values of the bimolecular rate constant for the fumarase reaction indicate that the rate of formation of enzyme substrate complexes is a diffusion controlled process. The dependence of this rate on electrolyte concentration agrees qualitatively with the theoretical predictions.

The solution of coupled rate equations near equilibrium

can be written as a system of first order linear differential equations. The solutions of these equations define the relaxation spectrum of a given mechanism. A general solution to this problem is formulated and detailed equations derived for the simple n-intermediate enzyme mechanism and competitive inhibition. The relaxation spectrum of competitive inhibitor-enzyme interactions is considered in detail. If the total substrate concentration is much greater than the total enzyme concentration, one relaxation time can be evaluated by considering only the steady state rate equation. The steady state relaxation time has been determined experimentally for the fumarase reaction, and steady state parameters (Michaelis constants, maximum velocities and inhibition constants) have been obtained by studying the relaxation time as a function of substrate and competitive inhibitor concentrations. The effect of pH on enzymatic relaxation spectra is discussed.

A critique of steady state enzyme kinetics is presented and the desirability of transient state measurements pointed out. Both steady and transient state measurements can be made on systems at or near equilibrium by determining the appropriate relaxation times.

Microfilm \$2.00; Xerox \$4.00. 71 pages.

A STUDY OF THE URANIUM(IV)-URANIUM(VI) ISOTOPIC EXCHANGE PROCESS.

(L. C. Card No. Mic 59-3042)

Daniel Monroe Mathews, Ph.D. University of Arkansas, 1959

Major Professor: E. S. Amis

The isotopic exchange reaction between uranium(IV) and uranium(VI) was studied in various compositions of alcohol and water as solvent. In order to better gain information concerning the effect of solvent upon this type of reaction, transference and solvation data were obtained on uranyl chloride in the same solvent compositions as were used in the kinetics studies. The kinetic reaction mixture consisted of uranium tetrachloride, uranyl chloride, hydrochloric acid, and U-233 as tracer material. The uranium species were present in a concentration of approximately .02 molar and the acid was present at a concentration of approximately .001 molar.

The rate of this reaction was found to increase as ethanol was added to the system up to a concentration of 90 volume per cent ethanol then decreased to 100 volume per cent ethanol. The order of the reaction was found to have three sharp changes with respect to solvent composition.

Transference and solvation numbers were determined for uranyl chloride, both as a function of concentration of uranyl chloride and as a function of concentration of ethanol in the solvent. The changes in transference numbers and solvation numbers occurred at the same solvent compositions as the changes in the order of the reaction.

The experimental results from kinetics, transference, and solvation studies are satisfactorily explained on the basis of a changing solvation sheath of the ions concerned.

A photoelectric device which can be used with a polarimeter to measure angles of rotation is described. This instrument gave a substantial increase in precision over the visual method.

An equation is derived for use in calculation of solvation numbers when an optically active substance is used as the inert reference material.

A method of preparation of uranyl chloride monohydrate is described. The method involves reacting the highly hydrated uranyl chloride with thionyl chloride.

Microfilm \$2.10; Xerox \$7.40. 158 pages.

## VIBRATIONAL RELAXATION PHENOMENA IN TRIATOMIC GASES.

(L. C. Card No. Mic 59-3409)

Donald Noel Montan, Ph.D. Oregon State College, 1959

Major Professor: J. C. Decius

The various theoretical studies of the rate of collisional excitation or de-excitation of molecular vibrations all indicate that the probability of collisional exchange of vibrational and translational energy is strongly dependent on the amount of energy exchanged. Thus a molecule with more than one degree of vibrational freedom might be expected to have several vibrational relaxation times, one for each vibrational mode. If each mode exchanges its energy with translational energy independently of the other vibrational modes the relaxation times should be quite different. However, if perturbations due to collisions allow rapid exchange of energy between the various vibrational modes a given mode may lose or gain energy as a result of a series of steps involving the other modes. In this case the various modes may all have similar relaxation times depending on the ease of energy exchange between the modes.

The usual methods of studying relaxation times which involve the measurement of heat capacity changes are not very suitable for the observation of the higher frequency vibrations since they have a small contribution to the total heat capacity. In the infrared spectrophone method, however, the molecular vibrations are excited by infrared radiation and the relaxation phenomena are observed as an increase in the pressure of the gas being studied.

A spectrophone developed for the purpose of studying the vibrational relaxation of each mode separately and suitable for the measurement of "long" relaxation times in the millisecond range is described. This instrument incorporates a monochromator to allow selection of radiation frequency. The radiation beam is interrupted at 13 c/s to assure that the period of interruption of the radiation is long compared with relaxation times even in the millisecond range.

A theory of the energy transfer process in a spectrophone cell is developed. This theory differs from previous theories in that it treats heat conduction and diffusional effects without restriction on the magnitude of the absorption coefficient of the gas. The results of the energy transfer theory are used in the development of an approximate theory of the response of a spectrophone cell. This theory gives the amplitude and phase of the pressure variations in the cell as a function of the various experimental parameters including absorption coefficient, chopper frequency, heat conductivity, absorption line half-width, pressure and sample composition. The theory treats the real shape of a vibration-rotation absorption band with rapid variation of the absorption coefficient with frequency. One result of this theory is the prediction of a loss of pressure variation amplitude as the total pressure is lowered. This loss, due to heat conduction effects, is accompanied by phase shifts in the opposite direction from those due to the relaxation phenomena.

Experimentally, pressure variation amplitude and phase shift were studied for mixtures of nitrous oxide and argon. In these measurements the mole fraction of nitrous oxide was varied from 1 to 0.05 while the pressure was varied from about atmospheric down to 1.5 mm Hg. Four infrared active vibrational bands were observed. The pressure variation amplitudes gave qualitative agreement with the theory of spectrophone response. Extraneous phase shifts ascribed to the pressure sensing microphone precluded any direct measurement of relaxation times. However, a comparison of the relaxation times for the four bands was possible. This comparison indicates that the high frequency fundamental vibration in nitrous oxide has a relaxation time, reduced to atmospheric pressure, of less than 5 microseconds as compared to the value of 1 microsecond for the low frequency fundamental determined by acoustic dispersion measurements. This result indicates that the de-excitation must take place through a series of deactivating collisions.

Microfilm \$2.00; Xerox \$5.40. 108 pages.

# THE INVESTIGATION OF KINETIC PROCESSES AND DIPOLE MOMENTS AND POLARIZABILITIES OF MOLECULES.

(L. C. Card No. Mic 59-3302)

Earl Miller Mortensen, Ph.D. University of Utah, 1959

Chairman: H. Eyring

The thermal decomposition of  $N_2O_5$  was considered theoretically and measured experimentally in CCl<sub>4</sub>. Using the mechanism of Ogg and the theory of absolute reaction rates the pre-exponential factor was calculated within a factor of about four. Plausible structures were assigned to both the  $N_2O_5$  molecule and the activated complex. Vibrational frequencies were also determined approximately using force constants taken from similar molecules. From the calculations made here it was found that the calculated pre-exponential factor could be brought into closer agreement if a looser structure was assumed for the activated complex. The experimentally determined rate constants were 20 to 30% higher than previous workers and the experimental activation energy 5 to 10% lower.

The rate of evaporation of liquids was considered theoretically in terms of the condensation coefficient.

These condensation coefficients have previously been shown to be closely related to the free angle ratio of Kincaid and Eyring. The free angle ratios of fourteen molecules were calculated as a function of temperature and

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compared with the experimental condensation coefficients where these were available. Other methods of estimating the condensation coefficient using the entropy of vaporization, the reduced temperature, Hildebrand's rule, and Pitzer's rule were considered. The theory of evaporation is discussed.

Electric dipole moments were calculated for halogen substituted aliphatic hydrocarbons where the moment does not depend upon internal rotation and halogenated derivatives of cyclohexane by the theory of Smith, Ree, Magee, and Eyring. The polarizability parameter for the C-C bond is changed while all other parameters retain their original value. In most cases excellent agreement with the observed moments of the substituted aliphatic hydrocarbons and fair agreement for the cyclohexane derivatives were obtained. The relationship of this theory to other theories for correlating dipole moments and structure is discussed.

General equations were obtained for the polarizability tensor of molecules in terms of the angles between bonds (or angles closely related thereto) and the angles describing internal rotations. These equations apply not only to polarizabilities but to any molecular tensor property which may be considered to be a tensor sum of bond and group properties. Tetrahedral molecules were considered, and the general equations were shown to simplify. An equation for the molecular anisotropy was derived in terms of the general equations. Examples were considered.

Microfilm \$2.00; Xerox \$6.80. 143 pages.

A METHOD FOR DETERMINING LIQUID-JUNCTION ELECTROMOTIVE FORCE BY CONTACT POTENTIAL MEASUREMENTS.

(L. C. Card No. Mic 59-2967)

Marvin Martin Mueller, Ph.D. The University of Oklahoma, 1959

Major Professor: J. Rud Nielsen

Among the fundamental questions of electrochemistry, one has always been especially tantalizing in its insolubility. From time to time, for nearly a century, it has been thought that the problem of determining single phase-boundary potential differences was essentially solved, only to have it recede even further into inaccessibility than before. To compound the frustration, the realization has simultaneously grown that this problem holds the key to several basic theoretical advances in solution chemistry.

A critical discussion of this problem is given in the light of recent conceptual advances. The conclusion is again reached that no hope exists for measuring the potential difference between two unlike phases. The hope for the future would seem to be in ever more exact theoretical calculations resulting from increasingly detailed knowledge of the molecular architecture of matter. However, for the present, there is a possibility of ascertaining the potential difference between two nearly identical liquid solutions of dilute electrolytes by means of contact potential measurements.

Somewhat elaborate apparatus was constructed for determining the contact potential difference between two

aqueous solutions by measuring the Volta potential differences between a nickel probe disk and each solution. A variable capacitance method was utilized with an electronic electrometer of ultra-high impedance. The precision of the Volta potential measurements was approximately 0.1 millivolt. Of the several refractory experimental problems encountered, the most difficult was the limited reproducibility of the contact potential difference caused by the orientation of dipolar organic impurities at the solution surfaces.

Between 0.01 N and 0.001 N HCl solutions, a contact potential difference of  $40\pm3$  millivolts was measured. This is to be compared with a theoretically calculated liquid junction electromotive force between the same solutions of 37 mv. It is believed that the 3 mv standard deviation is due to residual organic impurities and to a position asymmetry of the Volta potential of the nickel probe.

In order to achieve an accuracy of  $\pm 0.5$  my, necessary to make significant calculations of the activities of individual ions, certain modifications are suggested. In particular, it is believed that an ionization method would reduce the Volta potential position dependence of the probe to negligible values. In order to further reduce the amount of organic impurities it may be necessary to heat the solution vessels to incandescence before each measurement.

Microfilm \$2.25; Xerox \$7.80. 169 pages.

### THERMOCHEMISTRY OF CYANATES; ACID HYDROLYSIS OF POTASSIUM CYANATE.

(L. C. Card No. Mic 59-1788)

Ralph Arthur Myers, Ph.D. University of Nebraska, 1959

Adviser: Cecil E. Vanderzee

The acid hydrolysis of potassium cyanate has been studied from the chemical, kinetic and energetic view-points. The chemical study resulted in an improved method of purification of KNCO. The exact conditions necessary for completely stoichiometric hydrolysis to ammonia and carbonate have been found to require an acid concentration above 0.06 normal to suppress the side reaction forming urea. The acid should be added to the KNCO solution; solid KNCO must not be added directly to the acid solution or cyanuric acid may be formed. Previous data have been examined in the light of these new findings.

A high precision calorimeter has been designed and constructed to obtain kinetic and energy data. The calorimeter was tested by measurement of the heat of neutralization of NaOH and HCl and comparison of the results with accepted values. The precision was found to be excellent and the accuracy within experimental error.

The kinetics of the hydrolysis of KNCO have been studied in an acidity range where little information was previously available. The rate has been found to be dependent on the concentration of both H<sub>3</sub>O<sup>+</sup> and HNCO. This represents a profound departure from the situation previously found in a higher pH range where the reaction

is described as being approximately first order in cyanate only. In the acid concentration range of 0.08 to 0.4 normal, the decomposition of the cyanate has been found to follow approximately the relation,

$$-dC/dt = k(H_3O^+) (HNCO)$$

where k is equal to 7.3 liter mole<sup>-1</sup>, min.<sup>-1</sup> at 25°C.

The heat of hydrolysis has been measured in the calorimeter starting with solid KNCO and with aqueous KNCO in different experiments. The average of 16 runs when corrected to the standard state reaction

KNCO<sub>s</sub> + 
$$2H_{aq}^+$$
 +  $H_2O \longrightarrow K_{aq}^+$  +  $NH_4^+$ aq +  $CO_2(g)$  was  $\Delta H^O = -17,700 + 120$  cal./mole.

Necessary supplementary data were measured to correct the hydrolysis results to standard states. The dilution data for HCl in the literature were found to be in disagreement with results obtained here. At 3N and 4N respectively, 10 and 30 calories more heat per mole were found experimentally in dilution to infinite dilution. The average of four runs, measuring the heat of solution of KNCO to infinite dilution was  $\Delta H^{o} = +4846 + 32$  cal./

The heat of ionization of HNCO was also obtained calorimetrically. The average of 3 measurements was  $\Delta \text{H}^{\text{o}} = +2000 \pm 100$  cal./mole. The ionization constant of cyanic acid has been determined and compared with literature values. The result was  $K_i = 3.4 \times 10^{-4}$  at  $25^{\circ}\text{C}$ .

The heats of formation of solid KNCO, aqueous NCOion and aqueous HNCO were calculated from the experimental data by combination with the accepted values from National Bureau of Standards Circular 500, "Selected Values of Chemical Thermodynamic Properties," for the heats of formation of the remaining species involved. These values are respectively, -99,800, -34,920, and -36,920 cal./mole.

Microfilm \$2.00; Xerox \$6.00. 124 pages.

### ABSOLUTE ELECTROMIGRATION IN LIQUIDS.

(L. C. Card No. Mic 59-3127)

Aharon S. Roy, Eng.Sc.D. Columbia University, 1959

Absolute electrical mobilities and transport numbers in ionic liquids are defined in terms of the electrical component of the observed velocity - i.e. the velocity component of constituent i resulting from the application of the electrical field in the bulk liquid in a region of constant temperature, pressure and composition.

It is shown that these absolute electrical quantities are not known for any liquids except for some incomplete information in very dilute aqueous solution. This results from the fact that a bulk velocity,  $v^B$ , which does not cause relative velocity between constituents, is superimposed on the electrical velocity,  $v_i$ , to yield observed velocity,  $v_i$ , in all commonly used transport measuring devices. The bulk velocity may have several components, the most important of which are those resulting from electro-osmosis and from hydraulic flow.

The definition and use of the relative mobility and relative transport number for description of electromigra-

tion avoids the difficulty of the bulk velocity, but is of lesser significance for the interpretation of liquid structure.

It is shown by application of a momentum balance that in the bulk of a true liquid

### $\sum c_i M_i v_i = 0$

where  $c_i$  and  $M_i$  are the concentration and formula weight of constituent i, and summation is carried out over all the liquid constituents. As a consequence of this momentum rule, it follows that the mass-average velocity of the liquid, v', is equal to  $v^B$ , and, from this relation the value of the absolute electrical properties can be calculated from the measured relative properties.

This makes it possible to calculate absolute transport numbers (or transport fractions) in any fused salt on the basis of Hittorf numbers. The problem of transport number in pure fused salts like PbCl<sub>2</sub>, which has been a long-standing problem both experimentally and conceptually, is thus solved. Also, the problem of estimating the water migration by electromigration in aqueous solutions is solved and the question of "true" transport numbers is elucidated. It is also shown how electro-osmosis can be calculated from experimental data for conducting liquids in which electromigration and electro-osmosis mutually superimpose.

Degrees of freedom in transport are discussed and the connection between them and the degrees of freedom in thermodynamics is formulated. Shortcomings of various conventional methods for measuring absolute transport are shown, and a new experimental method is offered for measuring transport in which  $\mathbf{v}^{\mathbf{B}}$  can be controlled without the use of a membrane or porous plug.

Microfilm \$2.00; Xerox \$6.00. 121 pages.

### WETTING AT THE SOLID-SOLUTION INTERFACE AS A FUNCTION OF SOLUTE ADSORPTION.

(L. C. Card No. Mic 59-3388)

Richard Julius Ruch, Ph.D.

Iowa State College, 1959

Supervisor: L. S. Bartell

In the past, systems used for determining adsorption from aqueous solution have hindered concurrent measurements of wetting. In this study, the wetting of slides of small surface area by aqueous solutions of decylamine was measured as a function of the adsorption of the amine and the surface tension of the solutions. Adsorption at the solid-solution interface was measured in situ by an optical polarimetric method and wetting was determined concurrently by contact angle measurements employing the captive-bubble technique. Surface tensions were measured by the ring method. Adsorption isotherms and wetting measurements on platinum slides were uniform from trial to trial, but results on chromium were complicated by erratic kinetic effects.

Adsorption of decylamine on platinum in basic solutions occurred stepwise suggesting the formation of a second layer of decylamine which was subsequently verified experimentally. The character of the adsorption

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isotherms in acidic solutions indicated that adsorption was multimolecular and that the area per molecule of the adsorbed amine ions was larger than the area per molecule of the adsorbed amine molecules in basic solutions. The formation of micelles in acidic solutions reduced the proportion of ions available for adsorption and a plateau resulted in the adsorption isotherms beginning at the critical micelle concentration. The plateau extended to about twice the critical micelle concentration after which adsorption increased rapidly as the solutions approached saturation.

The observed contact angles of decylamine solutions on platinum rose to a maximum of about 100° as adsorption increased and then fell, sometimes to 0°, as adsorption proceeded further. A model was proposed for correlating these wetting results utilizing the concurrently measured adsorption isotherms. The isotherms were used to determine the fraction of the surface variously covered with patches of adsorbed water, adsorbed decylamine monolayer, and adsorbed decylamine double layer. The surface energy of the solid and the interfacial energy between the solid and the solution in Young's equation were replaced by the corresponding average energies of the above patches, a reasonable value for each patch being available from data reported in the literature.

The model was successful in predicting the general behavior of the observed contact angles and usually predicted complete wetting near the observed values. The calculated contact angle curves from this model generally fell between the observed advancing and receding contact angles, the maximum of the curves occurring near the maximum of the advancing and receding contact angles. The use of one or another of several reasonable values for surface and interfacial energies affected the exact shape of the calculated curves, but not the general aspect Microfilm \$2.00; Xerox \$4.60. 90 pages.

### VAPORIZATION CHARACTERISTICS OF SOME IRON AND CHROMIUM HALIDES.

(L. C. Card No. Mic 59-3346)

Rodney Jerome Sime, Ph.D. University of Washington, 1959

Chairman: Norman W. Gregory

The vapor pressures of FeCl<sub>2</sub>, FeBr<sub>2</sub>, FeI<sub>2</sub> (400 -470°C) and CrBr<sub>2</sub> (565°C) were measured by the torsion effusion method. A comparison of these data for FeBr<sub>2</sub> (400 - 470°C) and CrBr<sub>2</sub> (565 - 790°C) with vapor pressures measured by the transpiration method indicates that the vapor species are primarily monomeric. The vapor pressure data may be represented by equations of the form  $LogP_{mm} = -A/T + B$ ; for the above halides in the order listed, A = 9890, 10220, 9760, and 12050 and B = 11.10, 11.95, 11.82, and 11.06. Associated thermodynamic functions and bond energies have been calculated.

A simple, inexpensive ionization gauge control circuit was designed and constructed to measure residual gas pressures in the torsion effusion apparatus. With a VG-1A ion gauge tube, the measurable pressure range is 10<sup>-8</sup> to 10<sup>-3</sup> mm Hg.

The vaporization of CrBr<sub>3</sub> is complicated by simultaneous equilibria with CrBr2 and CrBr4, formed by decomposition and reaction with bromine, respectively. The equilibrium  $CrBr_3(s) + \frac{1}{2}Br_2(g) = CrBr_4(g)$  was measured by the transpiration technique from 473 to 593°C, at bromine pressures sufficiently high that no CrBr<sub>2</sub> was formed. The equilibrium constant may be defined as  $K = P_{CrBr_4}/P_{Br_2}^{\frac{1}{2}}$ , and its temperature dependence represented by the equation LogK<sub>mm</sub> = -7970/T

903

From 435 - 595°C the vapor pressure of CrBr<sub>3</sub> was measured by the Knudsen effusion method. The condensation coefficient was found to be near unity. A comparison of effusion and transpiration data indicates that CrBr, is primarily monomeric in the gas phase. The vapor pressure dependence on temperature may be expressed in the

form  $LogP_{mm} = -12,380/T + 12.82$ .

Bromine pressures were measured simultaneously with the CrBr3 pressures. Unlike CrBr3, the bromine pressures depended upon the effusion cell orifice size. For cell I ( $f = A_o/A_s = 1.07 \times 10^{-3}$ ),  $LogP_{mm} = -10,690/T + 10.83$  and for cell II ( $f = 3.8 \times 10^{-3}$ ),  $LogP_{mm} = -10,990/T + 10.69$ . Bromine pressures (542°C) were also found to be dependent on the degree of decomposition of the sample; the relation between bromine pressure and mole fraction was similar to that expected if solid solution were formed between CrBr3 and CrBr2.

Microfilm \$2.00; Xerox \$5.20. 103 pages.

### PROPERTIES OF DOUBLE MOLECULES AND THEIR EFFECT ON THE TRANSPORT PROPERTIES OF GASES.

(L. C. Card No. Mic 59-3291)

Daniel Ellis Stogryn, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Joseph O. Hirschfelder

In the first part of this thesis the second virial coefficient for molecules interacting with a spherically symmetric potential is divided into three parts: (1) a contribution Bb, related to the equilibrium constant for the formation of bound double molecules; (2) a contribution Bm, related to the equilibrium constant for the formation of metastably bound double molecules; and (3) a contribution B<sub>f</sub>, due to molecules which interact but are free to separate after the interaction. Equations are given for determining each of the three parts of the second virial coefficient. A detailed treatment of these three contributions together with numerical tables on a reduced temperature basis is given for the square well, Sutherland, and Lennard-Jones (6-12) potentials.

The mean lifetimes of metastably bound double molecules are discussed, and numerical values are given for the special case of argon. Tables for computing mean lifetimes in other Lennard-Jones gases are given. It is found that most metastably bound double molecules have mean lifetimes considerably longer than the mean time between collisions at ordinary pressures. Finally, an equation is developed for the number of vibrational levels of a double molecule.

In the second part of this thesis the initial pressure dependence of thermal conductivity and viscosity of gases is considered to arise from (1) molecular association and (2) collisional transfer. Since only the initial pressure dependence is investigated, clusters larger than dimers can be neglected. The effect of dimer formation can be calculated from a knowledge of the equilibrium constant for the reaction  $2A = A_2$ . The effect of collisional transfer is obtained by a semi-empirical modification of Enskog's theory. In the case of thermal conductivity, it is found that at low temperatures molecular association is more important than collisional transfer while at high temperatures collisional transfer predominates. For viscosity, the initial pressure dependence is due primarily to collisional transfer.

Detailed equations for the initial pressure dependence of both thermal conductivity and viscosity are given in terms of dimensionless groupings which include the intermolecular potential parameters. It is found that the numerical results are sensitive to the choice of force constants for the interaction of a monomer with a dimer. For molecules obeying the Lennard-Jones (6-12) potential, tables of these dimensionless groupings as a function of a reduced temperature are given. Comparisons between theory and experiment are included.

Microfilm \$2.00; Xerox \$5.80. 120 pages.

STRUCTURE, MOLECULAR ORIENTATION AND MECHANICALLY INDUCED REORIENTATION OF MOLECULES IN MULTIMOLECULAR FILMS OF LONG-CHAIN N-HYDROCARBON DERIVATIVES.

(L. C. Card No. Mic 59-3391)

Chester Louis Sutula, Ph.D. Iowa State College, 1959

Supervisor: Lawrence S. Bartell

The structure and molecular orientation in multimolecular films of a variety of long-chain, n-hydrocarbon derivatives have been systematically studied by electron diffraction. The films were prepared by evaporating dilute solutions of the compounds or by spreading the fused substances on polished surfaces of platinum or chromium plated steel. The observations were made over a large range of film thickness, from several molecular layers to several thousands of angstrom units. A polarimetric method was used to measure the optical thickness of the films.

In general, the multimolecular films had a crystalline structure. They were composed of many crystallites oriented with their 00 l planes parallel to the plane of the metal surface. The structure and the orientation of the crystallites were unrelated to the thickness of the films in films thicker than one molecular layer and were unrelated to the methods used in preparing the films. Films of very pure compounds even when only several molecular layers thick showed molecular packing and structural parameters which were characteristic of the pure, crystalline, bulk substances. The presence of even a few per cent of homologous impurities was found to change the structure and molecular orientation in films of most n-hydrocarbon de-

rivatives. This fact appears to account for the different results of some previous studies.

The molecular orientation in multimolecular films of many n-hydrocarbon derivatives could be altered by applying a shearing force to the film in one direction. Films reoriented by shear were composed of crystallites so arranged on the metal surface that the molecular chains were inclined at a small angle to the plane of the metal surface and were pointed up against the shearing direction. This reorientation sometimes occurred with a change in the polymorphic form of the crystallites in the multimolecular films. It was shown, however, that such a change was not a necessary condition for reorientation. The molecular orientation in reoriented films was unrelated to the original orientation of the crystallites in the film and depended solely on the shearing direction.

Two thermal methods were found for preparing multimolecular films in which the crystallites were oriented not only with their basal planes parallel to the substrate surface but also with their molecular chains inclined in the same direction over large areas of the film. The techniques appear to be applicable to many compounds that form films in which the molecular chains are inclined to the metal surface.

Microfilm \$2.05; Xerox \$7.20. 155 pages.

THE NATURE OF CERIUM(IV) IN AQUEOUS NITRIC ACID SOLUTION.

(L. C. Card No. Mic 59-3393)

Lourdes Ocampo Tuazon, Ph.D. Iowa State College, 1959

Supervisor: Frederick R. Duke

The monomeric cerium(IV) species in nitrate solutions of ionic strengths 3 and 5 were studied spectrophotometrically at  $24.5^{\circ}$  C. Evidence was obtained for the presence of  $Ce^{4+}$  (aquated),  $Ce(NO_3)OH^{2+}$ , and  $Ce(NO_3)_2^{2+}$  in solutions of the following composition: 0.001 M ceric perchlorate, from 1M to 3M hydrogen ion, ionic strength 3, and up to 2M nitrate. To interpret the data obtained, the following equilibria were assumed:

$$Ce^{4+} + H_2O + NO_3^{-} \stackrel{K_1}{=} Ce(NO_3)OH^{2+} + H^+$$
  
and

 $Ce(NO_3)OH^{2+} + H^+ + NO_3^- \stackrel{K_2}{=} Ce(NO_3)_2^{2+} + H_2O$ 

and values of 171 and 0.6 were estimated for  $K_1$  and  $K_2$  respectively.

In solutions containing 0.001 M ceric perchlorate, 3 M and 5 M hydrogen ion, and of ionic strength 5, the above equilibria were found to be valid up to about 1 M nitrate.  $K_2$  was evaluated to be 1.  $K_1$  at this higher ionic strength was not calculated; a lower value than 171 may be expected. At higher nitrate concentration, from 1 M to 4 M,  $Ce(NO_3)_2^{2+}$  and  $Ce(NO_3)_3^{+}$  seemed to predominate.  $K_3$  for the equilibrium

$$Ce(NO_3)_2^{2+} + NO_3^{-} \stackrel{K_3}{=} Ce(NO_3)_3^{+}$$

was approximated as  $1.7 \pm 0.3$ .

Evidence for the possibility of dimers with oxide or hydroxide bridges and complexed with nitrate in solutions high in nitrate and in ionic strength and low in acidity was also observed.

Microfilm \$2.00; Xerox \$3.00. 51 pages.

#### ECONOMICS, GENERAL

#### A HISTORY OF VOLUNTARY HEALTH INSURANCE IN WISCONSIN

(L. C. Card No. Mic 59-3166)

Leon Applebaum, Ph.D. University of Wisconsin, 1959

Supervisor: Professor Edwin Young

Within the last twenty years Americans have witnessed incredible growth in the field of voluntary health insurance. Although much has been said and been written about this growth on the national level, very little is known of developments on the local level. This study, which traces the growth of voluntary health insurance in Wisconsin, attempts to discover the contributing factors which led to the development of this type of insurance in the state.

After the initial chapter, which presents the historical development of voluntary health insurance on the national level, the study endeavors to present the "Wisconsin story" by analyzing the contributions of the following groups:

- 1. The Milwaukee County Medical Society
- 2. The State Medical Society of Wisconsin
- 3. The State Hospital Association of Wisconsin
- 4. The Commercial Insurance Industry in Wisconsin
- 5. Labor and Management in their collective bargaining relationship

It is the writer's contention that each of these groups has played an important role in the development of voluntary health insurance in Wisconsin. In presenting this study the writer also considers the economic and political factors that influenced the groups listed above in their decisions regarding voluntary health insurance.

The results of the study are summarized in the follow-

Voluntary health insurance began to emerge during the Depression of the Thirties when hospitals, adversely affected by the economic collapse, attempted to replace their primary source of income, the endowment, by establishing prepayment plans. These plans, which attempted to provide for the costs of hospital care by budgeting for such costs through prepayment, led to the birth of the Blue Cross

movement in the United States.

With the proven success of Blue Cross in Wisconsin and fear that government action was inevitable if it did not act, the State Medical Society of Wisconsin entered the prepayment field. The first successful Blue Shield plan in Wisconsin was promulgated by the Medical Society of Milwaukee County. An attempt to initiate one state-wide plan in 1946 resulted in a dispute between the State Medical Society and the Medical Society of Milwaukee County which continues currently. The causes and results of this schism are described in some detail.

Through competition with the "Blue" plans, the commercial insurance industry was aided in the expansion of voluntary health insurance. This study attempts to indicate the influence of this industry in Wisconsin.

Any attempt to present the development of voluntary health insurance must consider the effect of collective bargaining. Unions and employers have been interested in such plans for many years but it was not until the Second World War that labor unions increased their efforts in this area. By making use of Bureau of Labor Statistic studies and a survey of his own, the writer has attempted to indicate the influence of collective bargaining on the growth of voluntary health insurance in Wisconsin.

Overshadowing the growth of voluntary health insurance since the early Forties has been the overall economic prosperity that has characterized the American economy. This has made possible the expansion of benefits even though it has meant higher costs to consumers. It is very doubtful that voluntary health insurance could have grown to the extent it has had our economy been characterized by recession or depression. Had such been the case, it is very probable that instead of voluntary health insurance some form of national health insurance would have become the law of the land.

Microfilm \$3.65; Xerox \$12.40. 284 pages.

## PRICING EFFICIENCY OF MARKETING BEEF CATTLE IN SOUTH FLORIDA

(L. C. Card No. Mic 59-3542)

Louis Vernon Dixon, Ph.D. The University of Florida, 1959

In South Florida the combination of agricultural and urban development, influenced by geographical and climatic features, has brought about a livestock marketing situation in which non-competitive trading could exist. Production of beef in Florida in grades sold as fresh meat is only twenty-eight per cent of fresh meat consumption. This problem of deficit production is particularly acute in South Florida.

The competitive levels of recent prices paid for U. S. Choice and Good cattle in the Miami marketing area were evaluated by comparing them with estimated prices that would be expected under marketing conditions of reasonably pure competition. A competitive price level in an area of deficit production was defined as the price in the area of surplus production plus the transfer costs between the two areas. The estimated prices were derived from wholesale carcass prices, then converted to liveweight equivalents.

Prices paid by U. S. grade for live cattle F.O.B. plant Miami are reported weekly by Federal-State market news agencies. Impediments in pricing efficiency, as indicated by the failure of F.O.B. plant quotations to approximate derived competitive levels, were observed on numerous occasions for U. S. Choice steers. Similar impediments in pricing U. S. Good steers were not observed with any regularity.

Microfilm \$2.00; Xerox \$6.60. 138 pages.

### ACCURACY OF PRICING COTTONSEED FOR CRUSHING PURPOSES IN LOUISIANA

(L. C. Card No. Mic 59-3385)

James Francis Hudson, Ph.D. Iowa State College, 1959

Supervisor: Geoffrey S. Shepherd

This study was concerned with an evaluation of the accuracy of the present system for pricing cottonseed for crushing purposes at the ginner market, the development of theoretical grade standards for grading individual lots of cottonseed at the gin and an evaluation of the accuracy of alternative pricing systems based on the grade standards developed.

Linear regression analysis revealed a positive relationship between prices paid per ton for cottonseed by ginners and prices received by ginners from the oil mill. However, variations in prices paid explained only 59 percent of the variations in prices received. The analysis indicated that under the present system ginners tended to overpay producers for cottonseed with the least desirable qualities and underpay them for seed with the most desirable qualities. Individual bale lots of high quality seed did not command a price differential over less valuable seed. The analysis indicated that the pricing system failed to accurately reflect consumer preferences to the producers of cottonseed. Neither consumer satisfaction nor producer returns would be maximized under the present system.

The free fatty acid, oil and moisture contents of seed are the three most important factors affecting cottonseed grades. Satisfactory methods have been developed to determine the oil and moisture content of seed at the cotton gin. These two factors were used as a basis for the development of theoretical grade standards. The three alternative grade standards were based upon oil content alone, moisture content alone and oil and moisture contents combined. The data were stratified into three sub-groups for the grade analysis; seed containing 2 percent or less free fatty acid, 2.1 to 4.9 percent acid and 5 percent or more acid. Simple and multiple linear regression analysis revealed a highly significant relationship between the selected variables and grade in each acid group, except for moisture in the 5 percent or more free fatty acid group. The analysis indicated a very high relationship between all of the variables and grade for cottonseed containing less than 2 percent free fatty acid.

The theoretical grade standards were used as a basis for alternative methods of pricing cottonseed at the gin. Linear regression analysis revealed a highly significant relationship between the actual price received and the predicted price based on the alternative methods. The coefficients of determination were .88, .90 and .91 for the predicted price based on moisture, oil and oil-moisture estimated grades, respectively. Basing prices on oilmoisture estimated grades was the most accurate method. This method resulted in a 68 percent reduction in price variance as compared with the present system. The variance was very small for seed containing 2 percent or less free fatty acid. Any one of the alternative methods may be used to price individual lots of cottonseed at the gin and allow prices to reflect value variations arising out of differences in quality. This would result in a further reduction in pricing errors as compared to the present system.

The alternative pricing methods would lead to greater consumer satisfaction and higher producer returns than the present system. Microfilm \$2.00; Xerox \$7.00. 147 pages.

#### NATIONAL RESOURCES OF SPAIN AS A BASIS FOR AN INDUSTRIAL ECONOMY

(L. C. Card No. Mic 59-3052)

Edward Southard Little, Ph.D. The American University, 1959

As in the case of many other less developed countries, the Spanish government has adopted industrialization as the policy objective to raise living levels of the people. The field of the dissertation is the Spanish potential for economic development, examining particularly industrialization as a means to achieve higher per capita incomes through such development. The dissertation seeks to answer the question whether Spain has the resources -- physical and human -- to attain greater per capital incomes through industrialization.

The thesis which is developed is that Spain does have significant resources, particularly mineral and human, which offer the possibility for expanded development and a considerable degree of industrialization. Spain's human resources, which have been especially underutilized in the past, provide the greatest opportunity for stimulating development in the future. Spain's virtual isolation from Western Europe and the United States in the fifteen years following the beginning of the Spanish Civil War in 1936 has put it years behind the West in technology. However, Spain took the turn in the road in signing the September 1953 military and economic assistance agreements with the United States. Spanish culture is now meeting with another, on a mass basis, for the first time in many years. The barriers are being broken down and Spain is reentering the Western currents of thought and techniques.

The answer to the question of the speed at which Spain's development potential may be realized is dependent upon the rate at which it is able to overcome two existing limitations -- inadequate effective demand for industrial goods and an extensive shortage of capital. The conclusion is reached in the paper that there is considerable room for the state to take the initiative in creating demand by public works and other stimuli. And this is the course currently being pursued by the government of Spain. The shortage of capital is more difficult to resolve. Domestic rates of voluntary savings in Spain are low but ambitious government investment programs have been undertaken to provide capital for the industrialization program. The rate of capital formation from domestic resources has not, however, been sufficient. The Spanish government has sought and obtained substantial amounts of foreign public investment -- some of which has been provided on a grant basis -to fill the gap between domestic availabilities and the amounts of capital required to achieve what the Spanish authorities consider a satisfactory rate of economic growth.

Through associating itself with the West, first through the agreements with the United States and later by broader associations with the Organization for European Economic Cooperation, the International Bank and the International Monetary Fund, Spain has brought itself into touch with new sources of capital for its industrial development program and at the same time has established new channels for speeding the rate of its technical advance through an expanding interchange of people and ideas with the industrial West. With the opportunity the Spanish now have to improve their technology rapidly and with access to new supplies of capital, the prospects are much enhanced that Spain can significantly improve the utilization of its human resources and can speed the rate of the country's industrial development. Microfilm \$4.15; Xerox \$14.00. 323 pages.

#### MARKET STRUCTURE AND COMPETITIVE BEHAVIOR IN THE DAIRY INDUSTRY - THE PRESENT STATE OF KNOWLEDGE

(L. C. Card No. Mic 59-3272)

John Runyan Moore, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Robert L. Clodius

This is a study of market structure and competitive behavior in the distribution of six major dairy products: fluid milk, ice cream, butter, cheese, nonfat dry milk and evaporated milk. Part I of the study concerns the broad structural changes in the industry particularly those brought about by mergers. Part II of the study deals with market structure and competitive behavior in the various markets for dairy products from the time the raw milk leaves the farm until it is purchased by the ultimate consumer. Public policy suggestions for improving competition in each market are discussed.

The procedure used in the study was to collect pertinent data from every available source and analyze it within the appropriate theoretical framework. The framework or model found most useful was that of imperfect competition. The principal data sources were personal interviews, Federal Trade Commission complaints, records and reports, cases brought by the Department of Justice, materials published by the United States Department of Agriculture and state universities, and the hearings of congressional investigating committees.

Some of the more important findings of the study are listed below.

1. The dairy industry has been changing rapidly. Since 1940 the number of milk producers in the United States has declined 37 per cent, but production per farm is up 56 per cent. Producer cooperatives have increased their relative size considerably. Like the number of dairy farms, the number of processing plants of nearly all types has declined, but their average size in most cases has increased considerably. The principal reasons for these changes have been: changes in technology, changes in the number and size of buyers, development of flexible product plants, changes in laws and regulations, use of unfair trade practices, increasing labor costs, reduction of overhead costs, inequality of the Government's price support program, and instability of single proprietorships.

2. The largest firms in the dairy industry have been growing faster, relatively, than the industry. A significant portion of this growth is attributable to mergers. These mergers have public policy implications and some are

currently being investigated by the Federal Trade Commission.

3. The markets for all dairy products were found to be imperfectly competitive in the classical sense. In most cases, however, there is a fairly high degree of rivalry among firms because of the problems of joint-profit maximization. The principal factors found to be impeding joint-profit maximization were: heterogeneous cost curves, excess capacity, presence of cooperatives, countervailing power of large chain store buyers, product differentiation, antitrust laws, ability to secretly discriminate on price, and the desire for long-run expansion.

Several public policy suggestions were offered to improve competition in the dairy industry. Some were designed to increase competition and others to keep it running in proper channels. The suggestions included: better price reporting, passage and use of the premerger notification bill, more vigorous enforcement of antitrust laws particularly those designed to prevent price discrimination, allowing private parties to bring suits under section three of the Robinson-Patman Act, limitations on the good faith exemption in price discrimination cases, possible tax on excessive advertising expenditures, a second look at minimum retail markup laws, reduction of artificial barriers to entry, aid to small business through government financ-

ing and tax advantages, easier and more expeditious cease

and desist orders, greater originality to obtain patents, and

measures to increase trading on the commodity exchanges.

Microfilm \$6.35; Xerox \$22.00. 500 pages.

# METHODS OF ESTIMATING PROFESSIONAL INCOME IN THE COUNTIES OF OKLAHOMA

(L. C. Card No. Mic 59-2968)

Marion Carl Phillips, Ph.D. The University of Oklahoma, 1959

Major Professor: Dr. William N. Peach

In recent years income statistics have been widely used as a tool of economic analysis. Personal income is one of the significant measures of the economic achievements of the nation. The National Income Division of the United States Department of Commerce prepares estimates of personal income for each state. At present there is a need for methods to allocate the state totals among the counties of the several states.

Professional service income is one of the components of personal income. It is the income of professional practitioners engaged in independent practice. The National Income Division recognizes four professional groups: lawyers, physicians, dentists, and a miscellaneous "other" professional group.

In Oklahoma there are no data available for use in making a direct allocation of professional income among the counties. Hence, the writer examined sources which might be used to make an indirect county allocation of the state total.

Professional rosters and lists of lawyers, physicians, and dentists are available. A combination of these rosters can be used to compile a satisfactory county distribution of the number of each of these professional groups. Adequate

data are not available relative to the county income differentials of these groups. However, comprehensive data on wages and salaries of the labor force are available. Since professional income tends to follow the income of the general public, such data can be used for county weights.

A county distribution of the number of lawyers, physicians, and dentists was compiled for the calendar year 1957. The average annual county wage of Oklahoma employees covered by the Oklahoma Employment Security Act was computed from data published by the Oklahoma Employment Security Commission. The number of professional people in each county was weighted by the average annual wage in the county and a percentage allocator for each county computed. The National Income Division estimate of legal, physician, and dental income was allocated among the counties of the state. Rosters and lists of minor professional groups are not available. Therefore, "other" professional income for the state was allocated on the basis of county population, as shown in the 1950 Census of Population.

Microfilm \$2.40; Xerox \$8.40. 184 pages.

INFLUENCE OF FOREIGN TRADE ON THE LEVEL AND GROWTH OF NATIONAL INCOME OF CEYLON, 1926-57

(L. C. Card No. Mic 59-3218)

Warnasena Rasaputram, Ph.D. University of Wisconsin, 1959

Supervisor: Professor P. T. Ellsworth

Foreign trade is one of the most important links that Ceylon has with the rest of the world. Still more important is the fact that trade has been the single most dynamic factor in the economic growth of Ceylon. Historical data indicate that the exchange of primary goods against manufactured goods in general has led to a high degree of specialization in the trading countries in relation to one another. Expansion in trade has been disturbed by periods of instability. Nevertheless, the growth in incomes has been significant.

This study attempts to explain the role played by foreign trade in influencing the growth and level of national income in Ceylon. Empirical data are employed in studying the main factors that influenced economic growth between 1926 and 1957.

The high place given to trade came with the industrialization of the western countries and the subsequent rise in the standard of living which led to a greater demand for industrial raw materials as well as consumption goods such as tea and coffee. Foreign capital began to flow into Ceylon towards the end of the nineteenth century, mainly to finance tea and rubber plantations. Ceylon thus came to specialize in tea, rubber, and coconuts.

A high degree of specialization in a few export products and concentration of exports in a few markets have made the Ceylonese economy vulnerable to ebbs and flows originating in foreign countries. An attempt was made to measure the degree of fluctuations in export incomes originating in tea and rubber. Year-to-year fluctuations as well as cyclical and long-term fluctuations of these two products

showed that price varied sharply in contrast to quantity, which fluctuated only to a small degree. An export supply function fitted to tea and rubber export volumes and prices, using the method of multiple regression analysis, indicated that export supply was inelastic. Demand for these exports was also found to be inelastic. These factors have caused prices of exports to fluctuate sharply thus increasing the instability and unpredictability of export incomes.

The cyclical and secular changes in income have an 'asymetric effect' on consumption, wages, etc. For instance, consumption habits are irreversible once they are formed. Due to the operation of "ratchet effects," every rise in income takes the economy to a higher level of equilibrium or something approaching it. The Government has also intervened by taxation, social service benefits, etc., to push the economy in an upward direction. These factors have raised incomes. In money terms, per capital incomes have risen almost two and a half times during the last thirty years. When allowance is made for price changes, the growth of real per capital income has been negligible. Between 1926 and 1957 real per capita income has risen only 0.1 per cent compound.

It is believed that the terms of trade play a vital role in the economic growth of a country like Ceylon. If we measure the terms of trade contribution to real income relative to the base period 1948, we note that terms of trade made a significant contribution to the growth of real national income of Ceylon in the postwar period. On the other hand if the terms of trade contribution is measured relative to the base period 1934-38, we notice a fall in real incomes as a result of unfavorable terms of trade during most of the years since 1926.

We have also endeavored to obtain a quantitative measure of demand for Ceylonese exports. The export demand for Ceylonese goods by the chief customers and by the United Kingdom in particular was studied by using the method of single equation multiple regression and analysis. The demand for Ceylon's imports was similarly analyzed.

The export demand equations were used to predict the future demand for Ceylonese tea and rubber exports.

In conclusion, we have looked into a possible method of stabilizing export incomes and the national income of Ceylon. The method proposed in this study is the accumulation of buffer funds (foreign exchange) to stabilize the economic conditions of the island, the establishment of a stabilization fund to even out the fluctuations in export incomes and the replenishment of foreign reserves in times of severe depression by means of foreign loans and grants (which are to be repaid in domestic currency).

Microfilm \$4.50; Xerox \$15.20. 351 pages.

# PRINCIPLES OF ECONOMICS AND EDUCATION APPLIED TO THE MEAT ANIMAL INDUSTRY OF WISCONSIN

(L. C. Card No. Mic 59-3284)

Robert James Reierson, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Walter T. Bjoraker

There is a need for additional and more effective agricultural extension activities in the field of livestock and meat marketing. Chapter I provides a description of the livestock and meat industry of Wisconsin, its importance and market organization. Chapter II discusses the economic forces and issues which are important to the livestock industry, and some of the issues facing extension personnel working in livestock and meat marketing.

Chapter III discusses the role of extension education in terms of criteria for program formulation provided by considerations of the clientele and of the operational instrument—in this case the University of Wisconsin—and related aspects. Program evaluation is also discussed in this Chapter. The objectives of various groups and standards of value are very important in program development and evaluation.

Improvements in pricing efficiency are one of the main needs of the livestock and meat industry. Differential pricing can provide the most direct and effective incentives for changes in the quality of feeder pigs. Part B of Chapter IV reports research which attempted to develop a basis for a grading system for feeder pigs. This research attempted to identify characteristics of feeder pigs which are related to value differences while pigs are being fed out or when they go to slaughter. The expected slaughter hog grade and probable thirftiness of feeder pigs should both be considered in feeder pig grading, and the latter is the more important of the two. Other aspects relating to pricing efficiency for feeder pigs are discussed.

The present state of technology is not far enough advanced to justify the grading of feeder pigs and related pricing, on any basis except rough indications of variation in conditions of health. Further research is very much needed by the Wisconsin feeder pig industry.

A procedure is suggested for use in evaluating the learning situation and methods of presenting proposed changes in feeder pig grading and pricing. These could be utilized when a feeder pig grading system has been developed, or applied to extension programs related to present grading systems for other classes of livestock.

Research information is presented which is aimed at improving outlook information for both cattle and feeder pigs. There are many factors that presently limit the effect of outlook information. Factors and data related to establishment of auction markets are also presented.

Microfilm \$2.85; Xerox \$9.80. 220 pages.

FEDERAL AID TO DISLOCATIONS BY FREER TRADE:
READJUSTMENT ASSISTANCE TO INDUSTRIES
INJURED BY INCREASED IMPORT COMPETITION
DUE TO LOWERED TRADE RESTRICTIONS

(L. C. Card No. Mic 59-2867)

Otto Richard Reischer, Ph.D. Columbia University, 1959

Various methods designed to minimize economic dislocation caused by increased competitive imports without resorting to higher tariff duties and other restrictions on trade are examined. The desirability of greater freedom of trade is taken for granted.

Certain domestic producers face a problem of transition or adjustment to new conditions of trade, of changes in industrial structure of the country. This problem is aggravated by short-run immobilities. To accelerate the adjustment, adaptive (as opposed to sustaining) government intervention could be employed. Adaptive intervention works with, rather than against, the forces underlying the price system, and is self-terminating rather than cumulative. It facilitates the movement from one situation to another, but does not become part of the new situation. It would soften the impact of economic change upon individuals and groups directly affected, and would distribute the burden of the transition costs more equitably. A number of measures taken by European nations in connection with recent shifts in industrial structure are briefly noted.

Readaptation to increased imports is not an isolated phenomenon, but a facet of the process of economic growth. Since this type of adjustment takes place at a meeting point of domestic and foreign economic policy, its public policy aspect becomes as important as the economic aspects of the problem. In almost every industry there exists an interdependence of domestic and foreign competition. This has made it difficult for the government to move constructively, since acceptance of increased imports means economic shock for some domestic industries. A program of assisted readjustment would enable the government to insulate foreign trade policy from domestic economic problems created by freer trade. This would allow greater administrative freedom as well as greater precision in achieving policy objectives in the two fields.

Previous proposals dealing with adjusmtnet to dislocation by imports cover such a wide area that their efficient application appears impracticable. Some reach into the field of area development. While problems facing depressed areas overlap to some extent with dislocations caused by imports, they affect a far larger portion of the country's labor force and productive capacity. Measures for their solution will be taken irrespective of steps for coping with readaptation to increased imports. They would provide direct relief for communities and workers. and allow to concentrate the import readjustment program on the individual business enterprise. This would have the advantage of further narrowing the problem area of import-displaced domestic production, already quite small, compared to the national economic as a whole.

A set of criteria regarding organization and administration of an adjustment assistance program is given, followed by a discussion of possible ways of financing it, and by a model program in annotated outline.

Finally there are given three hypothetical applications of adjustment assistance programs in manufacturing, agriculture, and mining. One illustrative study shows the probable budgetary savings to be achieved by this type of program, in terms of reduced unemployment benefits and related public expenditures, in the case of the leather glove industry in Fulton County, New York. The two other illustrative applications deal with the public policy functions of readaptation and present problems likely to be encountered in devising assistance programs in wool growing and leadxinc mining. They also point the way to a lessening of resistance to freer trade on the part of certain domestic industries capable of mustering effective political opposition to any far reaching removal of trade barriers. The three studies show furthermore that the difficulties of and possibilities for readaptation vary greatly among different industries.

Microfilm \$2.95; Xerox \$10.20. 227 pages.

WATER ALLOCATION AND DEVELOPMENT IN WISCONSIN

(L. C. Card No. Mic 59-3221)

Alfred Allan Schmid, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Raymond J. Penn

### Statement of the Problem

There is a growing concern over the allocation and development of water resources in Wisconsin which coincides with the growth of agricultural, industrial, municipal, and recreational uses. The riparian doctrine which is the basis for water allocation in Wisconsin is being strained by changing circumstances.

This study examines the administration of water law at the state level in terms of the consequences for economic development. Major attention is given to resource control, meaning the written laws, administrative rules, custom, social sanctions, and other working rules controlling access to the use of water.

### Method of Analysis

The major idea of analysis is that institutional change and not only a reallocation of resources is required to restore order when conflicts develop because of the breakdown of the working rules.

Data for the study were secured by an examination of the Wisconsin Public Service Commission's files on surface water permits granted to agriculture and permits for hydroelectric dams. Personnel of the State Board of Health which grants permits for high capacity wells and other state officials concerned with water were interviewed. A historical account of water law development was obtained from library collections. Field data were provided by personal interviews of water users in three Wisconsin counties in the summer of 1958.

#### Results

Wisconsin has never taken a comprehensive view of its water problems. This has resulted in a failure to devise a policy framework into which the interrelated problems may be fitted.

Water law is evolutionary. Less than the ideal law must be accepted if the people can agree on it and it leads toward progress in the long run.

In considering allocation of water to agriculture, the law should be changed to allow consideration of the economic benefits of agriculture to the community.

The public interest is not homogeneous, but a compromise of conflicting publics. In granting permits to surface water, a hearing procedure is needed to bring the information important to all groups to bear on the decision. The criteria for allocation should be clearly specified in an administrative code.

Water administration should consider water as a single resource. Also different rules are needed to match the conditions of different areas.

A lower limit to streamflow below which no diversion is allowed is needed to protect public rights.

Of the water allocated to agriculture, the individual

shares should not be divided beyond the lower break-even point where the amount of water becomes too small for the farmer to stay in business.

Some basis for settling conflicts was found in the practice and custom of the people. Compromise between competing users is not likely unless the users recognize their interdependence and the possibility for collective action.

Care should be taken in allocation problems not to forget development possibilities. Water institutions should provide both flexibility and security of expectations.

Water use zoning was suggested for development of non-complementary uses to enable intensive development suited to the needs and capabilities of each watershed.

Research and planning should be carried on now to provide information to be used when future problems develop.

#### Conclusions

Two directional public policy decisions are needed. Both assume that domestic use has prior rights. (1) Wisconsin should allow water to be used on the best land rather than restricted to riparian land. (2) Wisconsin should abandon the absolute property rights doctrine of underground water for a policy of reasonable adjustment.

Microfilm \$4.20; Xerox \$14.20. 326 pages.

# THE ADAPTATION OF WISCONSIN RURAL FAMILIES TO CHANGING OPPORTUNITIES IN FARMING, 1950-1958

(L. C. Card No. Mic 59-3232)

Joseph Florentin Von Ah, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Robert L. Clodius\*

#### Statement of the Problem

A part of rural development is the agricultural adjustment problem in general. This problem is usually conceived by agricultural economists as a transfer problem. They find the norm for agricultural adjustment in the model of general equilibrium in which consumers' satisfactions are maximized and the returns to equivalent factors of production are equal to the marginal productivities of their respective contributions. Since income per worker in agriculture is lower than in other industries it is inferred that a transfer of resources is necessary in order to achieve more satisfactory income in agriculture and bring total agricultural supply in line with total demand.

The changes which are observed in our economy seem to conform to the model with all its ramifications as to technological advance, increased size of farms, decreased number of farms, and an increasing number of part-time farmers. However, it seems that the changes cannot be fully explained by differential marginal productivities, particulary not on the level of actions of individual farm families. Alternatives must be available and meaningful, otherwise no change in action will take place. This thesis then attempts to define, measure and interpret the adjustment problem on the level of individual family actions over the time period 1950-1958.

#### Procedure

The procedure used is an analysis of behavioral data which were secured in two farm family surveys. The first survey had been taken in 1951 and the second has been a follow-up survey in 1958. The alternatives which were identified are (1) leave agriculture, (2) start farming, (3) achieve economies of larger size, (4) part-time farming and (5) no change. It was expected that the individual farm family situation in terms of age of farm operator, the families' resources and their needs had a different bearing upon the alternative ways of action which were chosen by the farm people during the seven year time period.

### Results and Conclusions

Conceiving of the farm family as a unit of production and consumption it was found that in both of these activities the farm families show cyclical patterns. However in terms of use of family labor and family income no such patterns exist which means that farm families do adjust themselves over the life cycle.

In regard to the alternatives open for action we find that leaving agriculture was chosen primarily by the young farm boys before they entered farming as a career. Also young operators under 40 and tenants decided on other occupations as their career. For older people to quit farming has only meaning when they retire.

A successful start in farming is a family process. Farms of sufficient size are transferred as going concerns either on a partnership basis or as tenant farms. Off-farm work is no alternative to family transfer, except in cases of older semi-retired operators who farm more as a hobby than a commercial undertaking.

Part-time farming is the most effective means to leave agriculture. It was found to be a transitional stage or a permanent career. Family income of part-time farmers is consistently higher than that of full-time farmers.

All the farms under study showed some sort of change in all major variables which demonstrates that making adjustments is a continuous process.

The study shows that family processes are important for modifications in farm family careers, and for an understanding of the changes which can be observed on the agricultural scene. It can be recognized that people know how to adjust to changing conditions which implies that new public action programs are not needed to enhance the welfare of rural people.

Microfilm \$2.65; Xerox \$9.20. 203 pages.

\*In the initial, formative stage the study was supervised by Professor Kenneth H. Parsons.

### ECONOMICS, AGRICULTURAL

AN ECONOMIC ANALYSIS OF THE WISCONSIN FLORICULTURE INDUSTRY WITH SPECIAL REFERENCE TO THE WHOLESALE COMMISSION FIRMS

(L. C. Card No. Mic 59-3169)

Louis Michael Berninger, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Robert L. Clodius

The expansion of research programs in the production of florist crops following the close of WW II began to bear fruit in the early years of this decade. The wholesale crop value in Wisconsin rose from four million dollars in 1949 in excess of seven and one half million dollars in 1955.

The most notable production advances have been recorded by Florida and California. Increasingly larger volumes of the major cut flower crops have arrived in Wisconsin from firms principally located in these two states.

Wholesale producers have been caught in a price squeeze in that costs have steadily risen while prices have remained at levels prevalent in the late forties. A gradual shift from the production of one crop to another has given only temporary relief from this situation.

The principal objectives of this study were to: (1) describe the economic growth and value of the florist industry in Wisconsin, (2) to determine the market structure and performance of each segment of the industry, and (3) to analyze the effects of an imperfectly competitive market structure, effects of interregional competition, and the efficiency of the marketing system. Several hypotheses were tested, to determine the price and "cross" elasticities of demand, and the relationships between supplies and the value of marketings of various crops and the weekly prices of a major crop.

Wholesale commission firms were selected as a major observation point in this study. The analysis of prices was based on the procurement of data pertaining to consignment receipts and sales from three commission firms in Milwaukee.

Wholesale commission firms have operated in an oligopolistic market structure. Retail florists have purchased their supplies in competition with a large number of buyers and sold their merchandise in a monopolistically competitive market structure. The relatively small number of wholesale growers associated with each flower, in light of the competitive relationship between crops, would indicate they operate in an oligopolistic market structure. Growers have been unorganized, however, and performed as if they had operated in an atomistic market structure.

The entry of two new firms since WW II has increased rivalry between firms and advanced competition as the level of the wholesale market. Access to traders on the other side of the market, however, has been impaired by the absence of adequate market information.

The status of market information and standard grades has not been conducive to efficient trading and translation of consumer wants back to the producer. The pricing system also does not appear to have operated efficiently in light of significant differences in returns received by six growers from competing firms.

Flowers have been procured by the commission houses on consignment from local and outside growers and also by direct purchase from firms in other states. The latter method has been used at times on a speculative basis to secure higher net returns.

The price elasticity for roses was approximately minus .5, for carnations minus .4, and minus .2 for the two chrysanthemum crops. Local producers of roses have been most directly affected by shipments of this crop from sources in other states. Prices received by other growers may also have been affected, I wever, in light of the competitive relationship that has existed between crops.

Adequate and reliable market information would significantly improve the efficiency of the marketing system. The development of new markets and modification of the consignment contract would also appear to be important objectives designed to improve the welfare of the floral industry in future years.

Microfilm \$2.85; Xerox \$9.80. 218 pages.

### ECONOMIC EVALUATION OF DRAINAGE BENEFITS

(L. C. Card No. Mic 59-3376)

Willis George Eichberger, Ph.D. Iowa State College, 1959

Supervisor: John F. Timmons

The problems considered in this study are those arising from independent evaluations of single functions of a multiple-function resource development project. The first deals with developing an economic framework for project evaluation that will properly coordinate separate evaluations in a unified overall project appraisal. The second deals with the methodology of evaluating a single function of a multiple-function project.

Consequent objectives are to (1) formulate a framework for economic analysis of a project that will reconcile the broad public viewpoint of overall project appraisal with the private viewpoint of particular project effects, and (2) evaluate procedures used by the U. S. Department of Agriculture to appraise the drainage function of the Boeuf-Tensas-Macon Sub-basin Project located in Arkansas and Louisiana. The procedures are analyzed in terms of economic theory.

If a primary objective of resource development is to make the most efficient use of resources, marginal analysis may be usefully employed as a means of indicating how net benefits can be maximized. In this study the procedures used by the Department of Agriculture are analyzed to determine whether net benefits from the drainage function were maximized. Using the same input-output data as used by the Department, "linear programming" is employed to test the results obtained by the Department. This technique is used to determine if an optimum allocation of resources had been made by the Department, and to illustrate the possibility of using linear programming as a general method of determining the most efficient use of resources in watershed and river basin evaluations. As applied here, linear programming is concerned with three limitational resources - land, cash, and labor. For illustrative purposes the technique is applied to two land classes

in one stream reach of the Boeuf-Tensas-Macon Sub-basin. Results indicate that net benefits from drainage may have been underestimated considerably by the Department of Agriculture. The total difference in discounted annual net benefits from drainage of land classes 1 and 18 in reach T-2 of the Tensas River estimated by the two methods was \$17,240. The difference in discounted annual net benefits per acre of open land used for cash crops between linear programming and the budget method used by the Department was \$1.04. Comparison of the two methods for determining discounted annual net benefits per acre of woodland converted to open land cash crops showed a difference of \$2.28 per acre.

Because the linear programming analysis made in this study was so limited in scope, however, it is concluded that it is not safe to draw inferences from such a limited analysis. The substantial difference in net benefits obtained by the two methods suggests, however, that using the procedures of the Department did not reflect the most efficient use of productive resources.

It is suggested that linear programming can be used as an analytical check on other methods and also as an alternative method of determining optimum production programs.

Microfilm \$2.00; Xerox \$5.80. 119 pages.

# ALTERNATIVE PARITY FORMULAS FOR COTTON

(L. C. Card No. Mic 59-3379)

Lonnie Lee Fielder, Jr., Ph.D. Iowa State College, 1959

Supervisor: Geoffrey S. Shepherd

In this study several alternative methods of computing parity prices have been set forth and applied empirically to cotton. At the outset of this study, the following weaknesses of the present modernized parity formula were noted: (1) the base period 1910-14 is out of date; (2) the parity index is the same for all farm products; (3) the parity formula ignores changes in current quantities produced and purchased; (4) the parity formula disregards the variation in the rate of technological progress in the production of various crops and among areas; and (5) the parity formula does not provide for parity returns to resources used in farming.

The first alternative relating to parity price computations in this study, shifting the base forward to a more recent period, would merely make the statistical calculations necessary to maintain technically sound indexes simpler to carry forward. It would also recognize that there is no sound argument for indefinitely holding conditions constant as of any particular base period. The new parity calculations, however, would still not be any freer of the other various limitations of the present modernized parity formula.

The second alternative, computing separate indexes for each commodity, would eliminate the limitation of computing all parity prices from the same parity index. However, difficulties would arise in computing separate parity indexes for each commodity that reflect costs of producing these commodities in different areas.

The third alternative, the use of an efficiency modifier

in computing parity prices, would correct the limitation of not including a measure for changes in efficiency. The efficiency modifier, however, does not allow for changing weather conditions and does not account for differences in efficiency among areas producing the same commodity.

The fourth alternative, computing parity prices that give parity returns to resources used in producing a commodity, comes closer to overcoming all of the weaknesses of the present modernized parity formula. Parity returns prices, as computed in this study, are based upon a more recent base period, 1949-54. This period is more representative of present-day agriculture than a period far in the past. The parity returns prices, unlike the present modernized parity prices, are not computed from a single U.S. parity index which is the same for all farm products. Parity returns prices in each area depend upon the costs of production in its own area, not upon costs of production for the United States as a whole. Lastly, the parity returns formula provides a better measure of the economic status of farmers in that it is based upon current quantities purchased and sold rather than upon quantities purchased and sold in some base period.

Microfilm \$2.00; Xerox \$7.20. 152 pages.

# GAME THEORY APPLICATIONS IN AGRICULTURAL DECISIONS

(L. C. Card No. Mic 59-3395)

Odell Larry Walker, Ph.D. Iowa State College, 1959

Supervisor: Earl O. Heady

The study demonstrated the use of alternative decision models for farmer decision making under uncertainty. Particular emphasis was given to the Wald, Savage regret, Hurwicz and Laplace game theoretic criteria. Farmer decision problems were formulated as a game against nature. A farmer's alternative courses of action are regarded as his strategies and possible states of uncontrollable and unpredictable events are treated as nature's strategies. The game theoretic criteria are techniques for obtaining solutions to the game against nature.

Each of the alternative decision models implies certain goals for the decision maker. Thus, their usefulness for empirical application may be estimated by comparing their implied goals with actual farmer goals. Actual farmer goals may be deduced by examining possible problem settings. The study showed that a range of recommendations may be derived by using several decision models. Each possible recommendation tends to fit a different goal or farmer situation. Because of the diversity of farmer goals, it was concluded that recommendations by research or extension personnel should, perhaps, be based on several decision models.

The empirical problems considered were a particular class of within farm and within enterprise problems. They included problems requiring choice of crop varieties, kinds and amounts of fertilizer, crop enterprises, pasture mixtures, stocking rates and livestock enterprises. Techniques for using presently existing experimental data in the game framework were demonstrated. For example,

in one problem, farmer alternatives were oat varieties. States of nature were different years in which oat yields had been observed. The Laplace solution called for planting Clarion oats to maximize long run yields. To obtain a maximum short run security level, the Wald solution suggested planting 56 percent of oat land to Clintland oats and 44 percent of Sauk oats. A farmer's problem setting would determine which of these recommendations he elects to use.

Microfilm \$2.40; Xerox \$8.40. 181 pages.

### ECONOMICS, COMMERCE - BUSINESS

AN ANALYSIS OF ACCOUNTING SYSTEMS AND PRACTICES WITH IMPLICATIONS FOR IMPROVEMENT OF INSTRUCTION IN ACCOUNTING

(L. C. Card No. Mic 59-3358)

Wilma Alice Ernst, Ed.D. The University of Oklahoma, 1959

Major Professor: Gerald A. Porter

The purpose of this study was to analyze current accounting systems and practices in an effort to ascertain implications for instruction in accounting at the secondary and college levels. The problem has four significant aspects: (1) to survey selected businesses in an attempt to determine accounting procedures and practices utilized; (2) to gain from accounting personnel detailed information relative to accounting duties performed and the preparation of individuals for performance of said duties; (3) to analyze certain textbooks currently used in instruction in accounting to determine the extent to which instructional material is in accord with current procedures and practices; and (4) to ascertain the educational implications of the data obtained and to develop recommendations for improvement of instruction in accounting.

The data for this investigation were obtained through personal interviews with the owners or managers of 108 selected business enterprises in Alva, Oklahoma, and with the personnel responsible for accomplishing the accounting functions in these specific businesses. The data thus obtained were used as the basis for analysis of the instructional content of accounting textbooks in use in bookkeeping classes at Alva High School and in elementary accounting classes at Northwestern State College. A comprehensive interview guide was used to assure a high degree of uniformity in the data obtained.

The conclusions reached in this study are:

- 1. Accounting systems and procedures used in business organizations are such that they can be readily classified and correlated in terms of duties performed by individuals. Since instruction in accounting is designed primarily to prepare people to fulfill duties in specific accounting occupations, it is concluded that a close relationship does exist and should be facilitated between actual practice and instruction in the schools.
- 2. Basically, instructional material as presented in accounting textbooks is sound in principle, but it is concluded here that, to the extent that current practices and

procedures are not reflected, the textbooks are inadequate as the major source of information for preparing individuals to fulfill functions in accounting in both large and small business enterprises.

- 3. Elementary accounting textbooks should include more instructional material relative to suitable records for small businesses that will be simple to maintain yet provide adequate information for management purposes. If the textbooks are not revised in this regard, it is evident that teachers will have to rely upon supplementary material if this aspect of accounting is adequately presented to students.
- 4. Business teachers must be familiar with the current accounting practices used in businesses in their communities if they are to be certain that current practices are represented in the textbooks and in the instructional activities in their accounting courses.
- 5. Since accounting practices change with new laws and new developments in technology, studies such as this one should be repeated at intervals and in different parts of the country.

  Microfilm \$2.25; Xerox \$7.80. 169 pages.

### DEVELOPING A PRE-RETIREMENT COUNSELING PROGRAM FOR A STATE UNIVERSITY CIVIL SERVICE SYSTEM

(L. C. Card No. Mic 59-3262)

Clyde Arthur Jaworski, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Alanson H. Edgerton

This study was undertaken to determine the financial, leisure time, health, and family relationship problems of civil service employees retired from the University of Wisconsin, and to use such findings in developing an adequate pre-retirement counseling program for those who face future retirement.

One hundred and seventy-five retired people cooperated by reacting to questionnaires and interview procedures, with the following results:

Of the four areas studied, finances and health were found to be the major problems. Leisure-time problems were much more apparent than those involving family relationships.

The biggest financial problem was found to be inadequate income after retirement which gave rise to related personal adjustments. Health and finances were closely related, as the cost of health services affected a number of these people.

Illnesses necessitated many changes in the manner of living and presented some serious individual adjustment problems.

Leisure time did not seem to represent any real disturbing situations. However, lack of a hobby, loneliness, and poor health, among others, led to occasional personal problems.

Illness and death within the family, separation by miles, and finances sometimes caused minor difficulty in family relations. Sharing living accommodations with children likewise led to certain individual situations.

The program designed to alleviate these difficulties

can be categorized into three parts: Distributing educational materials on the subject of retirement to all employees; counseling each employee periodically from age fifty-five until retirement; and assisting individuals who request further help after retirement.

In the first part, the proposed procedure consists of orientation meetings with new employees and all supervisors to emphasize planning for retirement. Written material will be distributed on the current retirement plan and articles are to be published in the employees news organ. A library of books and magazines on retirement likewise is to be made available. A recreational program is to be inaugerated to provide opportunity for the development of special interests. Also, greater use of medical facilities will be stressed to enhance reaching retirement age in good health.

The second part starts when the employee reaches age fifty-five. Seven meetings, five group and two individual, are to be arranged before each employee reaches age sixty-five. The first one, on attaining age fifty-five, is planned as an individual conference with the program director to inform each employee of the entire content of the program.

Shortly thereafter, a group meeting will place particular emphasis upon the retirement plan, Social Security, insurance, and motivation to begin retirement planning.

The next group meeting, to be held six months later, is scheduled to discuss investments and budgeting and the pros and cons of various living arrangements. Specialists would assist the director with these discussions.

Still another group meeting, scheduled at about age sixty, is planned to discuss common diseases of older people, significance of physiological changes, diets, and physical activities. Also, discussions would deal with availability, coverage, and cost of health insurance. Appropriate specialists also would assist with this meeting.

Another group meeting, scheduled at about age sixtyone, would include specialists to discuss leisure-time topics. Summaries of available facilities, activities, and programs would be distributed and discussed.

A final group meeting, health approximately six months before retirement, would devote its agenda to general reminders of health, living activity, insurance, and investment matters of individual interest.

Just prior to retirement, an individual conference will be arranged with the director when all necessary retirement forms can be processed and a final annuity choice made. Part-time work possibilities and other privileges will also be discussed.

Individual follow-up and evaluation are integral features of part three. Questionnaires will be sent and periodic interviews arranged with all interested retired personnel.

This study has provided pertinent data on one group of retired personnel and proposed a pre-retirement program based on these data. This program should strengthen the personnel structure of the Civil Service System at the University and may give helpful information to others planning similar services.

Microfilm \$2.25; Xerox \$8.00. 172 pages.

A CRITICAL EVALUATION OF INCOME MEASUREMENT BY "PRODUCTS" AND "PERIODS"

(L. C. Card No. Mic 59-3345)

William Joseph Schrader, D.B.A. University of Washington, 1959

Chairman: Kenneth B. Berg

For measuring periodic income in manufacturing enterprises, accounting employs a conventional procedure requiring classification of costs successively as capital and revenue expenditures, product and period costs, assets and expenses. The "direct costing" argument about the nature of product and period costs and numerous other criticisms marshalled in Chapter II suggest the need for a thorough reappraisal of the conventional procedure.

In this thesis, the writer has undertaken after thorough and contemplative study of pertinent accounting, economics, law, and engineering literature of the last sixty years to delineate the assumptions and concepts which seem most general in accounting determinations of income. His original contribution has been making these generally-accepted elements explicit and organizing selected ones into a general framework which permits accounting determinations of income in several contexts and from which can be drawn inferences about the validity of conventional procedures.

An understanding of conventional practice is sought first through a historical study of the major forces by which it has been affected. Extension of functional classification of costs to manufacturing from merchandising enterprises and the concept of cost attachment seem especially important.

The delineation of the concepts implicit in accounting income is approached in the context of a completed venture. The elemental data of accounting are limited to an entity's transactions stated in monetary units. These contain apposite classes of services received (costs) and services rendered (revenues). The disparity between costs and revenues which is connoted by "income" results from omission of services from entrepreneurs from total costs.

It is recognized that in practice income is not usually evaluated for completed ventures. Instead, either revenues or costs (usually the former) are analyzed into concurrent or successive segments nominally designated as products, etc., or periods. The apposite class of data are then "matched" with these segments by reference to implicit standards among which "benefit" and "responsibility" seem to be most generally favored. The writer believes that the "differential" method permits a determination of costs exclusive to a revenue segment in the sense that it alone benefits from (or is responsible for) them, but that it generally (or invariably) leaves a cost residue common to two or more segments whose allocation must be somewhat arbitrary. He favors the "contribution" form of income report because it explicitly delineates separate from allocated common costs apposed to revenues.

A study of accounting literature dealing with income of concurrent segments such as joint products or departments discloses that separateness and commonness are already-known qualities of costs. In this context they are usually called direct or departmental versus indirect, joint, or non-departmental. Their presentation in contribution form seems to be gaining favor.

Accounting literature on periodic income measurement

does not so clearly recognize separateness and commonness as cost qualities. The distinction between revenue expenditures and amortization of capital expenditures is an approximation, but it seems to be essentially traditional and it lacks the precision that differential analysis might provide.

The relatively recent "direct costing" method—not yet generally accepted—seems to the writer to be essentially a distinction between separate (variable) and common (fixed) costs. He believes that it represents an application in periodic income measurement of methods which are already generally accepted in divisional income measurement. If fixed costs be recognized as costs common to two or more periods, their evaluation will require an approach similar to that for costs common to two or more divisions; i.e., joint costs. The direct costing method with slight modifications corresponds to the contribution method gaining favor in divisional analyses. Accordingly, it should be regarded as an equally "accepted" method.

Microfilm \$2.35; Xerox \$8.20. 177 pages.

ECONOMICS, FINANCE

THE INVESTMENT PERFORMANCE OF LOW YIELDING STOCKS, WITH RELEVANCE TO THE MARKET APPRAISAL AND VALUATION OF PROSPECTIVE GROWTH

(L. C. Card No. Mic 59-3164)

Hadi H. Alwan, Ph.D. University of Wisconsin, 1959

Supervisor: Professor Frank Graner

The study deals with the nature and the significance of the differential in current dividend yield among common stocks. Specifically, it seeks to investigate whether meager current yield is usually, or on the average, compensated for by subsequently superior dividend growth and/or capital gain. This is done by contrasting the performance of stocks selling on a lower than average yield with the performance of the market averages and with the performance of stocks selling at higher yields than the market averages over the period between 1946-1956.

A distinction is made between low yield stocks with high price/earnings ratios and low yield stocks with low price/earnings ratios depending on whether the price/earnings ratio of a stock is higher or lower than the price/earnings ratio of the Moody's Industrial Stocks. Another distinction is made between a) stocks whose low current yield is due to a declining dividend with the price not declining or declining less than proportionately to the decline in dividend, and b) stocks whose low current yield is due to stable or rising dividends and earnings and dynamic price appreciation. This latter type of stock was referred to in this study as the low yielding "growth stocks" to distinguish it from other low yielding stocks which are referred to in this study as the "special situation" low yielding stocks.

On the basis of equal investments in each stock and the

market averages, the low yielding group of stocks continued throughout the period to be at a significant disadvantage in average cumulative dividends and average yield on original investment compared to the high yielding stocks and the market averages. Nor was there any reasonable basis for assuming that a longer period might have altered the above results. This was true of the general sample of low yielding stocks as well as of the low yielding "growth stocks" sample referred to above. The low yielding stocks with high price/earnings ratios were at greater disadvantage in dividend performance than those with low price/earnings ratios.

In spite of definite disadvantages in dividend return, not all the groups of low yielding stocks were inferior in terms of price appreciation. However, where the low yielding stocks showed greater average price appreciation than the high yielding stocks, the difference was not sufficiently large to be statistically significant. In summary, the low yielding stocks remained significantly inferior in dividend income over the period from 1946-1956 without being significantly superior in price appreciation compared to the high yielding stocks or the market averages.

The failure of the low yielding stocks to offset their initial disadvantage of meager return over a decade of generally favorable economic and market conditions does not deny the merit of bona-fide growth stocks selling on low yields. It does, however, indicate that for the average investor who is not equipped to differentiate between actual growth stocks on the one hand and popular stocks or nongrowth speculative stocks on the other, the low yield must be regarded as more than a temporary disadvantage. This is especially true when the low yield of a stock is also accompanied by a high price/earnings ratio.

Microfilm \$2.25; Xerox \$8.00. 171 pages.

A THEORY OF STATE SALES TAX SHIFTING AND INCIDENCE

(L. C. Card No. Mic 59-3041)

John Brandhorst Koch, Ph.D. University of Arkansas, 1959

Major Professor: H. P. Jenkins

This dissertation is an extension and application of the money-flows theory of sales tax incidence developed by Jenkins¹ to sales taxes that are less than national in geographical scope. The method of analysis is, with some modifications, that used by Jenkins. The principal tool used to locate incidence is Imputed Retail Price, a benchmark that isolates all changes in prices and incomes that are of purely monetary origin, so that the remaining changes in the model represent sales tax incidence.

The direction in which sales taxes are shifted depends (in order of importance) on the use made by government of the tax revenue, the relative size of the State levying the sales tax, and the rate of taxation. Considering each State separately, the sales tax tends to be shifted forward if the government uses the revenue to hire factors of production, or if the State levying the sales tax accounts for a small fraction of the nation's income. But if the revenue is used to buy goods or make transfer payments, and if the State

accounts for a large percentage of the nation's income, the tax load tends to be shifted backward to the owners of the factors of production.

When the theory is applied to the State sales taxes in the United States, where many States have sales taxes but at varying rates, the national average pattern of government spending and rates controls the direction of shifting. Using data for fiscal 1956, the national average State-Local sales tax rate is 2.64%, and on the average 59% of the State sales tax load is shifted backward. However, the percentage shifted backward is greater in individual States with below average rates, while in States with above average rates the preponderance of the tax load is shifted forward. This occurs because the amount shifted backward in each State depends its income and national money-flows aggregates.

The distribution of the forward-shifted sales tax load among the buyers of various goods is proportional to expenditures if the sales tax in the State is general at a uniform rate. But if different goods are taxed at different rates, or if some are not taxed, the sales tax load is concentrated on the buyers of goods taxed at higher than average rates, and if the bulk of the net tax load is shifted backward, this concentration of gross load on the buyers of these goods provides a negative tax load or subsidy for buyers of goods taxed at below average rates or not taxed at all. This phenomenon is known as horizontal shifting.

The sales tax load shifted backward is distributed proportionally to income among the owners of factors of production if production takes place under constant cost conditions. If diminishing returns are present in production, the distribution of backward-shifted tax load depends on the extent to which the governmental fiscal operations alter the composition of the national output. When the composition of output changes, the backward-shifted tax load is concentrated on the owners of fixed factors in the contracting industries, while the owners of fixed factors used in expanding industries receive less than their proportional share of the load.

Microfilm \$2.55; Xerox \$8.80. 194 pages.

1. H. P. B. Jenkins, "Excise-Tax Shifting and Incidence: A Money-Flows Approach," <u>Journal of Political</u> Economy, Vol. 63 (April, 1955), pp. 125 ff.

THE EFFECT OF CHANGES IN INSTITUTIONAL AND INDIVIDUAL DEMAND FOR CORPORATE SECURITIES ON THE STRUCTURE OF THE CAPITAL MARKET, 1920-1955

(L. C. Card No. Mic 59-3292)

Morris Leonard Stevens, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Walter A. Morton

The principal objective of this study is to analyze the structure of the corporate capital market. We study the reasons why demand for stocks lagged in the early postwar period when dividend yields based on market prices were much above bond rates. Relatively high costs of equity to the levels of new issues of corporate stocks in

the early postwar period as compared with the twenties. We emphasize investor demand as a determining factor in the high cost of equity.

We examine the pattern of corporate investments of the two main investor groups--institutions and individuals. An attempt is made to determine the level and classes of corporate security investments by all savings, financial, and miscellaneous institutions as compared with individuals. We discover changes in institutional holdings of both corporate stocks and bonds as a percentage of estimated outstandings of each. By estimating the growing importance of institutional savings as a part of total personal savings, we are able to measure the shift in the savings process from direct individual savings to savings through intermediary institutions. The growth of institutions is shown by their annual average savings of about 60 per cent of personal savings in the postwar years compared with 30 per cent in the twenties. The rising importance of institutions reduced the demand for equity securities, since their investments were predominately bonds. Their depressing influence on the equities market, however, was less than might have been expected for the following reasons. First, institutional investments in stocks increased from the twenties to the postwar period, particularly in the fifties. Second, even though institutions absorbed a greater share of personal savings and invested relatively less of these funds in stocks than individuals, large holdings of individual investment funds still flowed into the possession of high income individuals. Since there has been a long-term declining trend of stocks as a percentage of total personal savings, individuals still had sufficient investment funds to supply large amounts of equity. This was the case despite high tax rates on high income individuals and available taxexempt securities. There is sufficient evidence to show that individuals failed to invest as large a percentage of their savings in stocks in the period 1946-1949 as they did in the twenties.

We conclude that the high cost of market equity capital in the period 1946-1949 was only partially due to structural changes in the investor community. A more important factor apparently was investors preference for bonds. Individual investors had sufficient funds to buy somewhat more heavily in equity without causing an abnormal balance of their portfolio, but because of uncertainties concerning prosperity and corporate profits, they avoided stocks. The increase in demand for stocks in the first half of the fifties was a result of a shift in individual preference plus increased institutional demand.

Because of weak investor demand for stocks, cost of corporate equity capital was high compared with bonds in the early postwar years. The response of corporations to the relative cost of stocks and bonds stems from the fact that as cost rose for stock capital new issues of stock lagged. In the period 1946-1949 new stock issues were relatively few, but in relation to the level of the cost of bonds it would appear that fewer stocks would have been issued. Apparently, corporations resist distorting their capital structure beyond a limited degree even though debt capital is cheaper.

Microfilm \$4.75; Xerox \$16.00. 372 pages.

# ECONOMICS, THEORY

### A QUARTERLY ECONOMETRIC MODEL OF THE CANADIAN ECONOMY

(L. C. Card No. Mic 59-3311)

Leo Irwin Bakony, Ph.D. University of Washington, 1959

Chairman: Arnold Zellner

An aggregative model of the Canadian economy is constructed and tested statistically. The model consists of ten linear equations in ten endogenous variables. Six of the equations are behavioral relationships, two are technological transformation functions and two are identities.

The behavioral equations include a consumption equation, two investment equations, and an export equation. The technological transformation functions include a production function and a depreciation equation. The identities represent two tautological relationships necessary to close the system.

The forms of the structural equations are specified by economic theory and verified, where possible, by the results of existing similar empirical studies. These sources are therefore examined selectively as a preliminary step. The strongest of the many possible hypotheses are then selected for testing. A further choice is made among alternative hypotheses on heuristic grounds. The hypotheses selected must be amenable to time series data.

The data employed in the estimation process are next assembled and discussed. The data sources are publications of the Government of Canada. These data are not released in forms directly tractable to use in aggregative models. Adjustments are made for price changes and for seasonal fluctuations. Gaps in the data are filled by interpolation and/or by projection. In some cases entire series are constructed from scattered components.

The model is examined with respect to the necessary conditions for its identification. When identification is established the structural parameters of the model are estimated. There exist a number of alternative methods by which parameter estimates can be obtained. Alternative methods of estimation are therefore examined with respect to their statistical properities and relative costs of computation. The question of choice of estimation techniques is found to be an open one on theoretical grounds. The method of least-squares is selected for preliminary estimation with the intent of subsequent estimation using a simultaneous equations approach. The computations are performed on an electronic digital computer. The program employed provides the regression coefficients and certain statistics which test the significance of the results.

The equations are evaluated on the basis of the preliminary results, and test statistics. Those equations which perform poorly are subjected to modifications suggested by the results. The modified forms are reestimated and the results compared with the preliminary estimates. There emerges from this experimental process a final model which is subjected to further tests.

The completed study provides a closed aggregative quarterly model. It provides evidence that certain hypotheses are consistent with observable data at a predetermined level of significance, and that other hypotheses are inconsistent with observable data at the same level of

significance. The sample data are used in this way for the first time in the present investigation.

The study throws light on certain technical problems of estimation. The estimation of distributed lags, multicolinearity among variables, and the deflation of money variables are some of these problems. A number of directions for further research are indicated by the results. First among these is the necessity for disaggregative sector studies. The need for a comprehensive empirical study of inventory relationships is made apparent by the results of the present investigation. A more detailed examination of the foreign trade sector is also suggested.

The results obtained and the general scope of the project indicate the investigations of the present type cannot be regarded as complete. Availability of fresh data, development of new computational techniques, and progress on conceptual and theoretical problems all impose the requirement of continuous revision and reestimation of such Microfilm \$2.00; Xerox \$5.80. 116 pages.

### WAGE AND PRICE DECISIONS IN THE BASIC STEEL INDUSTRY (1945-1956)

(L. C. Card No. Mic 59-3241)

Allan James Braff, Ph.D. The University of Wisconsin, 1959

Supervisor: Associate Professor Peter O. Steiner

This dissertation explores three major issues: (1) the relative importance of political and economic factors in determining the size of wage bargains in the basic steel industry; (2) the relative influence of "power" (pertaining to bargaining power) and "equity" categories of economic variables on wage bargains in this industry; and (3) the relation of pricing decisions to wage decisions under conditions which appear to apply in the steel industry and in

other important oligopolistic industries.

The early chapters of the thesis are concerned with the selection of the relevant variables for subsequent analysis. An initial list of potentially relevant variables is selected by reviewing the history of the several post-war wage bargains in the steel industry, by surveying the considerable theoretical and institutional literature on wage determination, and by examining the criteria mentioned as important by the participants in the collective bargaining negotiations. The explanatory value of economic variables taken singly is briefly explored using zero-order correlation analysis. This analysis shows that economic variables taken singly fail systematically to explain the size of wage bargains in five of the ten post-war negotiations; for these bargains political-institutional factors appear to offer plausible explanations for the discrepancies between the actual wage bargains and the regressions on selected economic variables.

Two alternative hypotheses are then explored. The first is that political and economic variables interact in a systematic way. A theoretical model is formulated which suggests both the nature of the relevant variables and the nature of the interrelationship. This model, based upon restrictive assumptions that appear to be met by the basic steel industry, yields a pattern of behavior that is broadly consistent with the observed wage bargains.

The second hypothesis is that some collection of economic variables jointly account for the variation not explained by economic variables examined single. Combinations of variables are explored using multi-variate statistical techniques. The best of these combinations explains a large and significant portion of the variation in the size of the wage bargain. This analysis suggests that certain of the "power" variables -- those representing the urgency of the demand for steel by the public and private sectors of the economy--alone have a large explanatory value. Of less influence on the size of the wage bargains are economic variables relating to operating characteristics of the steel industry and economic variables relating to the size of the labor supply. Economic variables pertaining to equity proved of least explanatory value, notwithstanding the fact that they are the most often articulated in collective bargaining discussions.

This result reinforces the findings of the theoretical model. For, by showing that the variables that are most significantly associated with the size of wage bargains are those that are most likely to regulate the industry's price decisions, the door is opened to admitting the significant non-economic restraints on price behavior that are identified in the theoretical analysis, and that are summarized

in the concept of a "public-limit" price.

In sum, the ability of the steel industry to shift the burden of a wage increase by increasing prices appears to be the crucial factor in determining the ultimate size of the wage bargain. This ability in turn is reflected most keenly in the so-called power variables and in the political feasibility of price increases.

Microfilm \$3.55; Xerox \$12.00. 275 pages.

### A CRITIQUE OF WORLD-WIDE ECONOMETRIC FORECASTING

(L. C. Card No. Mic 59-3269)

Kiichiro Kogiku, Ph.D. The University of Wisconsin, 1959

Supervisor: Associate Professor Peter O. Steiner

Colin Clark's ambitious book The Economics of 1960, published in 1942, was concerned with making world-wide economic forecasts of agricultural prices, agricultural working population and production, and real income. The forecasts, made separately for individual countries of the world, rest upon an econometric model of the world economy. Because the forecasts relate to the year 1960, it is now possible to evaluate the accuracy of the predictions and to appraise the adequacy of Clark's basic model. The purpose of this thesis is to make such an appraisal, and to use it as a guide to sound principles of subsequent economic projections.

In general the forecasts have not stood the test of time. The level of agricultural prices relative to non-agricultural prices in the world (the so-called terms of trade) has risen only about 20% above the 1925-34 level, not the 90% predicted. Further, there has been substantial variation in the changes among individual countries. These changes, furthermore, have not followed the pattern which Clark predicted. Clark's predictions about agricultural working population and real income have been very poor.

More generally correct have been the forecasts about agricultural production.

The reasons for the failure of the projections have been explored with some care. For it is possible that poor predictions can reflect, for example, errors in estimates of exogenous variables working within a system that is basically accurate. Such, however, is not the case. The structural equations are not satisfactory. The estimates of exogenous variables are not satisfactory. Finally, and perhaps most important, the general assumptions regarding world equilibrium have been sharply contradicted by actual developments.

With respect to the structural equations, it was found that: (1) the consumption function of agricultural products was too high and steep; (2) the rate of fall in agricultural productivity due to the increase in density of agricultural working population was unacceptable; (3) the alleged relationship among sectoral productivities and the terms of trade was rejected; and most importantly; (4) the structural equations contained such large errors that the forecasts based on such equations would produce forecasts with large margins of errors.

With respect to the exogenous variables, it was found that: (1) the forecasts about working population were a total failure; and (2) no steady trends in productivity growth exist which will make productivity projection over twenty

years possible without too large errors.

Finally, Clark's general assumptions regarding world equilibrium were that competition and free international trade would be maintained in the world agriculture. On the contrary, government interference has been increased since the war to alleviate food shortages and balance of payments difficulties. The government interventions have not been reduced, nor are likely to be reduced, for such reasons as national security, planned economic development in socialist and underdeveloped countries, and protection of agricultural population in developed countries.

In sum, Clark's attempt is neither a success nor even a near miss. What may be learned from this? Productivity projection remains extremely difficult despite Clark's contention to the contrary, and further techniques must be developed to reduce errors. More important are the findings on the terms of trade. The terms of trade do not move in the same direction in all countries, and this diminishes the usefulness of the concept. Furthermore, the terms of trade have acquired rigidity in recent years, and may very well be assumed to remain stable in future world-wide economic projections. In spite of more promising results in the projection of demand for service and agricultural sectors, any future progress in world-wide economic projection is largely contingent upon further development in theoretical and empirical study of economic growth.

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### ECONOMICS OF THE AIRCRAFT INDUSTRY

(L. C. Card No. Mic 59-3347)

Gene Roger Simonson, Ph.D. University of Washington, 1959

Chairman: Dean A. Worcester

This study investigates three aspects of the aircraft industry; namely, (1) the history of the industry, (2) the present market structure of the airframe industry and the resulting forms of competitive behavior, and (3) the role of the United States Government in its relations with the industry.

The industry was slow to develop from the invention of the airplane in 1903 to World War I when aircraft were mass produced as weapons of war. Except for the periods of the "Lindbergh Boom," around the time when Charles Lindbergh made his trans-Atlantic flight, and from 1935 to 1940 when exports increased significantly, relative growth in the industry has been based largely on domestic military demand. Technological change and new product development have been ever present in the 40 year history of the industry. Manned combat aircraft, which have accounted for by far the largest proportion of the industry's sales in the past, are presently being superseded by pilotless missiles. Although the aircraft firms are prime contractors on most missile projects, entry by electronics firms in the production of missiles is taking place.

The market for the products of the industry is divided into two main sectors—the military market and the civil market. The civil market is further sub-divided into the market for commercial transport aircraft and utility aircraft. In 1956 the military market amounted to approximately 85 percent of total aircraft sales. Commercial transport sales accounted for about 13 percent and utility aircraft sales about two percent of the total.

In the military market a monopsonistic-oligopolistic market structure exists with the Government as the only buyer and five companies producing around 75 percent of the output value. Bilateral oligopoly prevails in the commercial transport aircraft market with only three domestic producers for the several years prior to 1958 and 12 domestic air lines operating 76 percent of the scheduled aircraft. Four producers account for 97 percent of the output value in utility aircraft production while buyers in this market number in the thousands.

In the monopsonistic-oligopolistic military market, the results have been intense competition in produce design, proposed product prices, and proposed delivery dates. This has led firms to plow back 65 percent of profits in recent years into research and development projects and has caused active competition in the factor market for highly qualified scientific and engineering personnel. The superior bargaining position of the monopsonist has enabled it to determine the nature of the product it wants produced, select the firm or firms it wants to produce it, determine the contract terms, set the price of the product it will pay, and finally re-set the product price at a later date if it thinks a firm has made excessive profits. Combined profits after taxes as a percent of net worth of 12 top producers were 17 percent in 1957. Net worth in relation to sales is low compared to other leading industries because the Government owns approximately two thirds of the value of production facilities.

Under conditions of bilateral oligopoly in the commercial transport market, producers compete actively in terms of product design and delivery dates. Price competition is not so apparent because competitors' products are usually significantly differentiated. The power of the sellers over the larger number of buyers is demonstrated by their ability to administer fixed base prices, demand favorable contract terms and get well above average profits. Buyers exercise their bargaining power by making sellers responsive to their wishes in basic product design and differentiation to suit individual needs.

The four dominant producers in the utility aircraft market produced 15 different basic aircraft models in 1958 designed to satisfy a variety of buyers' tastes. Seven of these models could be considered competitively close substitutes in terms of performance characteristics and price. Firms appear to concentrate to a greater extent on new demand creation than on intra-industry competition. Oligopolistic market power over buyers is revealed in the high rate of net profits as a percent of net worth which ranged between 19 percent and 36 percent for the three top producers in 1957.

The Government has given indirect assistance to the civil aircraft manufacturing industry through efforts to promote civil air transport and government financed military aircraft research and development. The policy of giving large orders to a few producers has resulted in industrial concentration, assembly line production, and economies of scale. Various legislative acts since 1934 have provided for profit limitations on government contracts. Except for two five-year programs in the 1920's and the 1930's, the Government has followed no policy to give the industry stability.

The military airframe industry should be considered as a "natural oligopoly." The Government should continue to allocate contracts among few producers to benefit from economies of scale. At the same time it should seek to maintain enough producers to insure a competitive environment conducive to efficient production and new product development. The Government as a monopsonist has the market power to insure that the public interests are best served while maintaining this type of market structure in the industry.

Microfilm \$3.90; Xerox \$13.20. 302 pages.

#### EDUCATION

EDUCATION, GENERAL

AN ANALYSIS OF THE OUTCOMES OF FUNCTIONAL MATHEMATICS AND FORMAL MATHEMATICS AS MEASURED BY CERTAIN OBJECTIVE TESTS AFTER COMPLETION BY THE STUDENTS OF TWO YEARS OF STUDY

(L. C. Card No. Mic 59-3036)

William Jack Bush, Ed.D. University of Arkansas, 1959

Major Professor: Roy B. Allen

### Purpose of the Study

The purpose of this investigation was to determine if there was a significant difference between the functional program and the formalized program of mathematics in the Springfield Public Schools as measured by certain objective tests after two years of study. Also if these differences were found in the areas of arithmetic reasoning, arithmetic fundamentals, algebra or geometry.

### Method of Research

A master list of all students who fit the requirements of this study was established and test results were obtained for each of the students at the end of the two years of study. In addition a retest was administered to a randomly selected group approximately three months later to test retained learning. It was strongly suspected that differences in ability existed which would have invalidated a simple comparison of means. Therefore, to eliminate the differential effects of reading ability and non-language mental

ability of the two groups of students, it was decided to control on these variables by the use of analysis of covariance. The decision had been made before this study that the acceptance or rejection of the null hypothesis would be at the 1 per cent level of confidence. To assist with the determination of the location of the variation and to clearly indicate the effects of the analysis of covariance on the desired variables, adjusted mean scores were computed for arithmetic reasoning, arithmetic fundamentals, algebra and plane geometry.

### Summary

The null hypothesis, that no differences existed between the two groups, in light of the evidence of this study must be rejected. The students who completed two years continuous study in fuctional mathematics are significantly different from the students who followed the formal program. At the immediate conclusion of the two years of study the traditional group was superior in all areas tested. The analysis of the retest which took place three months after the completion of the course illustrated there were no significant differences in the areas of arithmetic fundamentals and plane geometry but did reveal highly significant differences in arithmetic reasoning and algebra. It also should be observed that nowhere in the original tests or retests were the students of functional mathematics superior to the students of traditional mathematics and in only two areas of the retest were they equal. The results of this investigation lead to the following concluding statements:

1. That students who follow two years continuous study in formal mathematics are significantly superior to the students who study two years in functional mathematics in the areas of arithmetic reasoning, arithmetic fundamentals,

algebra, and plane geometry at the end of the period of study.

2. That three months after the completion of the two years of study the students following the formal program of mathematics are superior to the functional students in the area of arithmetic reasoning and algebra.

3. That in no way are the students of functional mathematics superior to the students of traditional mathematics in the areas tested.

Microfilm \$2.15; Xerox \$7.60. 162 pages.

# THE RELATIONSHIP OF A COMMUNITY NEWSPAPER TO THE EDUCATIONAL PROBLEMS OF ITS COMMUNITY

(L. C. Card No. Mic 59-3180)

Adrain Alfred Cohn, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Edward A. Krug

Statement of the Problem: This study is a description and identification of the role of a community newspaper in the study and discussion of educational problems. The newspaper is the El Cajon Valley News, a semi-weekly of about 10,000 circulation, serving primarily the city of El Cajon and unincorporated areas of El Cajon Valley, located in San Diego County, California. Particular emphasis has been placed on the period since 1953, at which time Simon Casady, the present publisher, purchased the newspaper.

Procedure: Data for this study were gathered from back files of the El Cajon Valley News, from other documents connected with matters under study, and from interviews with Casady, members of local school staffs, and other citizens. While back files of the newspaper were complete, documents and records were not always so. Therefore, interviews were heavily relied on, not only to elaborate and clarify events for which records were complete, but also to provide chronologies and backgrounds leading to the actions taken by those groups for which few written records were available. In addition, interviews were used to identify and assess the role of the newspaper in the discussion of educational problems.

Findings and conclusions: The Valley News, according to the values it holds relative to education, at various times has been a defender and a critic of school policies and practices. Attempts to determine the influence of the newspaper on the eventual outcomes of local issues were inconclusive. These outcomes were, however, consistent with the editorial point of view of the newspaper. While the newspaper did not originate study or discussion related to educational policies or issues, its news stories and editorials served as catalysts in some instances to bring these matters to a high degree of public awareness. This suggests that a newspaper might use its news stories and editorial comment to originate the study and discussion of educational issues prior to or at times other than periods of crisis. Such activity might promote public interest and wide public participation through citizens' groups working with the schools to construct good educational programs.

Microfilm \$3.50; Xerox \$12.00. 272 pages.

# A PROGRAM OF ACCREDITATION FOR PRIVATE BUSINESS SCHOOLS

(L. C. Card No. Mic 59-3356)

Edward James Coyle, Ed.D. The University of Oklahoma, 1959

Major Professor: Dr. Gerald A. Porter

Under the auspices of the Oklahoma Association of Private Business Schools, this research was undertaken to develop a program of accreditation for the private business schools in Oklahoma. The specific problems involved were the identification and isolation of essential elements in the operation of a successful private business school offering programs of instruction primarily at the equivalent level of the thirteenth and fourteenth grades in the public schools; the development of criteria for measuring the degree of conformity to these essentials by a private business school; and the formulation of guides, procedures, and instructions for implementation of a state-wide program of accreditation.

All available literature relative to the history of the private business school movement and public-school business education, and the development of accreditation was surveyed. From this survey, elements essential to the successful operation of a private business school were formulated and tested as to appropriateness. The testing was accomplished by submission to various individuals and groups deemed capable of valid constructive criticism. Subsequent to development of the essential elements, criteria were developed for measuring conformity of a school to the essential elements. These criteria were tested and revised where needed. An organization was developed and procedures were outlined for implementation of the program of accreditation. These were critically analyzed by competent persons and revisions and improvements were incorporated where needed. Finally, a document was developed for use in Oklahoma. The document is currently used as a guide for the accreditation program in Oklahoma under the authority of the Oklahoma Accrediting Commission for Private Business Schools.

Based upon the sustained interest evidenced and active cooperation received, it may be concluded that there is genuine interest among representatives of business and industry, higher education, and private business schools in a program of accreditation for private business schools in Oklahoma. From this interest, continued progress and improvement should result among private business schools in the State.

Evidence in this study substantiates the conclusion that elements essential to successful operation of a private business school can be isolated and that criteria for measuring conformity of a school to these essentials can be developed.

The most significant conclusion is that the plan for an accreditation program for private business schools in Oklahoma presented in this study is feasible in the opinion of private business school owners, managers, and teachers in Oklahoma. This conclusion is based on the acceptance of the program and its current implementation.

Microfilm \$2.50; Xerox \$8.80. 191 pages.

THE HIGH SCHOOL STUDENT'S PERCEPTION OF MOST-LIKED AND LEAST-LIKED TELEVISION FIGURES

(L. C. Card No. Mic 59-3095)

Lois Jean Davitz, Ph.D. Columbia University, 1959

Previous portraits of major mass media figures have been based on the perceptions of various communication specialists, and it was hypothesized that these perceptions differ from those of a typical mass media audience. Therefore, in the present study the perceptions were investigated of a particular audience, the high school student, in terms of choice and description of most-liked and least-liked television figures.

Approximately 3000 high school students in Norfolk, Virginia, chose their most-liked and least-liked figures and described them by means of a 101-item check-list. Appraisal of the data revealed homogeneity of both choice and description of figures. Less than ten figures accounted for over 70 per cent of the most-liked choices which included a number of cowboys such as Matt Dillon and Maverick, a few young male figures such as Dick Clark and Ricky Nelson, and only two women, Lucille Ball and Patti Page. Among the least-liked choices, Arthur Godfrey was selected by approximately 20 per cent of the students, while no other figure was selected by more than ten per cent of the population.

Most-liked choices were described as good, friendly, attractive and happy. Least-liked choices were described as silly, mixed-up, conceited and unattractive. Boys differed from girls and Negroes differed from whites in their choices and descriptions of most-liked and least-liked figures. It was also found that, within the 14 to 18 year old age group considered in this study, there were no consistent differences related to choices and descriptions of figures. The one exception was that younger white girls differed from older white girls in the choice but not the description of a most-liked figure. Although the subjects of this study included all ranges of socio-economic classes, there were no class differences with respect to either choice or description of figures.

Specific findings regarding the various choices and descriptions were described, and the results were discussed in terms of previous research, implications, and proposals for further investigation.

Microfilm \$2.00; Xerox \$5.60. 111 pages.

VOCABULARY GROWTH IN THE ELEMENTARY SOCIAL STUDIES AS INFLUENCED BY THE USE OF SELECTED AUDIO-VISUAL MATERIALS

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(L. C. Card No. Mic 59-3188)

Nicholas Peter Georgiady, Ph.D. University of Wisconsin, 1959

Supervisor: Professor Edward A. Krug

# The Problem

The purpose of this study is to identify the effect of the use of selected audio-visual aids including carefully

selected and appropriately used 16 mm. motion picture films, 35 mm. filmstrips, and other projected pictures on vocabulary growth in the social studies in specific situations.

The Design of the Study

Classes in the sixth, seventh, and eighth grades in the Shorewood and Whitefish Bay, Wisconsin public schools were equated on the basis of intelligence quotients and reading vocabulary test scores. Control and experimental groups were designated for the first unit and were rotated for the second unit. Control groups used all types of audiovisual materials except those involved in the projection of pictures. Experimental groups used all audiovisual materials including films, filmstrips, and the opaque projector.

Vocabulary lists were made up from all books used by the students. Multiple choice vocabulary tests were constructed from these lists. The tests were checked for reliability with non-participating groups and were administered to the students in both the control groups and the experimental groups at the beginning of each unit, at the termination of each unit, and six months following the termination of each unit to measure growth and retention of vocabulary items. Individual gains and mean gains were computed and compared statistically.

The Findings

- Experimental groups using films, filmstrips, and the opaque projector showed larger gains in unit vocabulary than their control groups.
- Coefficients of correlation obtained between I.Q. scores and gains made by students in the unit vocabulary tests ranged from +.07 to +.50.
- Coefficients of correlation between standardized reading vocabulary grade placement scores and gains on vocabulary test scores ranged from +.10 to +.63.
- Subjective judgments by teachers indicated that the use of audio-visual materials was of value in motivating learning.
- 5. Comments by students indicated that they preferred situations where audio-visual materials were used as they were an asset to better understanding of the subject matter.

These findings revealed that the proper use of films, filmstrips, and other projected pictures was of value in the situation described. Where these experimental media were used, vocabulary growth was increased. While there was growth in vocabulary comprehension in the control groups, there was greater growth in the experimental groups. The motivational effect of the use of these media appears to have carried over into the social studies unit activities which were conducted outside of the class as well as with activities carried on in the classroom.

An opportunity to increase pupil growth in as basic a skill as vocabulary comprehension is worthy of every consideration for the beneficial effect this, in turn, may have in generally improving learning. The results obtained in this study indicated that in the situation described, a significant increase in vocabulary growth occurred where films, filmstrips, and the opaque projector were used.

Microfilm \$2.80; Xerox \$9.80. 216 pages.

### THE HUMANITIES IN COLLEGE PROGRAMS OF GENERAL EDUCATION: ORGANIZATIONAL APPROACHES

(L. C. Card No. Mic 59-3546)

Ned LeRoy Haven, Ed.D. The University of Florida, 1959

The purpose of the study was to examine the organizational approaches which have been used in the development of humanities programs in selected college programs of general education. More specifically the study sought to (1) examine the selected humanities programs to determine their philosophic, administrative, and operational characteristics, (2) classify the organizational approaches being used, (3) study the relationship between the stated goals of the humanities and those of general education, (4) describe the current practices in humanities courses in the light of the stated aims of the humanities in general education, and (5) analyze the implications of the organizational approaches.

In preparing the study, recently published materials in the field of general education were surveyed, with particular attention to humanities programs. Twenty-five institutions were selected for study and analysis, and correspondents in these institutions provided a variety of helpful materials such as outlines, syllabuses, and other information regarding humanities offerings. The information derived from these sources was organized to provide (1) a picture of the program of each institution, (2) the classification of the several organizational approaches, and (3) an examination of the relationship of humanities and general education goals.

The prevailing kinds of philosophical foundation evidenced by the institutions of the study proved to be of three broad types: neo-humanism, rationalism, and instrumentalism. Of these the most common type was that of neo-humanism, an approach which sought the preservation of the values of the western tradition through the study of the cultural heritage. The preoccupation of rationalism was found to be that of the cultivation of powers of the intellect, while that of instrumentalism was concerned with the personal growth of the individual learner.

The most common method for the administration of humanities was found to be some type of independent or semi-independent control which permitted those engaged in such instruction to pursue general education goals with relatively little interference from traditional departments. A favorite device was the use of a special general humanities staff

Five principal approaches to the operation of programs of humanities were evidenced. The most popular of these was the modified survey or integrated course approach which attempted to provide a unified humanities experience. The distribution requirements plan found in many institutions required the student to earn a prescribed amount of credit in designated humanities areas. Other types observed were the great books approach, the individualized curricula approach, and the functional subject matter approach.

Taken collectively, the general education and humanities goals of the institutions of the study were found to be in agreement with the more commonly accepted statements of goals which appear in the literature of general education. The most commonly mentioned general education

goals were those having to do with the development of qualities of broad perspective, good citizenship, and critical thinking. The most frequently mentioned humanities goal was that of providing an acquaintance with the cultural heritage, which was itself one of the lesser general education goals.

The institutions of the study implemented their humanities goals through a variety of practices in terms of subject matter, instructional materials and methods, and procedures of evaluation. It was found that the subjects generally conceded to be appropriate to the humanities were literature, the arts, philosophy, and sometimes history and religion. Of these, literature was the most common, being included in every program.

Microfilm \$3.05; Xerox \$10.40. 233 pages.

# DIFFERENTIAL VALUE OF THE MAILED QUESTIONNAIRE AND THE INTERVIEW IN A FOLLOW-UP STUDY OF HIGH SCHOOL GRADUATES

(L. C. Card No. Mic 59-3261)

Robert Morton Jackson, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor J. W. M. Rothney

Evaluation of guidance may require some form of follow-up study to ascertain the behavior, performances, and opinions of those who have been counseled. The investigator who attempts a follow-up study may be faced with a choice of using either mailed questionnaires or interviews. This study was designed to determine the differential value of these two follow-up procedures in eliciting responses from high school graduates.

The Wisconsin Counseling Study which was concerned with the effectiveness of counseling was conducted in four Wisconsin schools. All the subjects who remained to graduate responded to a mailed questionnaire five years after high school graduation. Tape recorded interviews were held with a sample of 50 subjects from this population. The questions used in the interview were memorized by the interviewer who used the exact wording and sequence as they had appeared on the mailed questionnaire. Comparisons were made of the responses elicited by the two procedures on the basis of completeness, type, number, and uniqueness of response. Comparisons were made of the

time and expense involved in the use of the interview and

questionnaire methods.

Study of the differences in responses to mailed questionnaires and interviews revealed that the interviews elicited a significantly greater number of completed responses that gave evidence of problems and adjustments of the subjects in the five years after high school graduation. An average of two out of every three subjects responded consistently to items in the questionnaire schedule. For every dollar spent for the mailed questionnaire follow-up study, approximately sixty dollars was spent on interview procedures.

It was clear that differential values did exist in the responses to the mailed questionnaire and interview studies. It appeared that the difference in the cost and time involved in securing data from representative secondary

school graduates by the interview rather than the mailed questionnaire was justified by the more complete responses which the interviews produced and by the added evidence about the subject's performance, behavior and opinions.

Microfilm \$2.00; Xerox \$6.00. 121 pages.

### EFFECTIVENESS OF PRISM TRAINING ON THE IMPROVEMENT OF READING AT THE FIFTH GRADE LEVEL

(L. C. Card No. Mic 59-3153)

Ray E. Jongeward, Ed.D. State College of Washington, 1959

The plan of this experiment was based on the hypothesis that eye difficulties of a convergence nature may deter children from utilizing skills already learned, or from developing latent abilities in reading. The purpose of this six-week study was to determine the effect of prism training on the achievement of fifth grade children who were retarded in reading.

In the careful selection of the sample population, children who had visual acuity ratings below 20/20 and who were achieving within one year of their ability level (or above) were screened out of the study. Children who were found to possess normal convergence patterns were also dropped from further consideration.

The four factors of sex, mental age, chronological age, and degree of convergence insufficiency were taken into consideration when assigning the children to six comparison groups. Prism and "placebo" types of eye training were randomly assigned, singly and/or in combination with the remedial reading instruction. Different forms of a standardized reading test were administered before and after the six-week experimental period to measure reading achievement. Analysis of covariance, analysis of variance, and the F-test were used on the statistical treatment of the data.

Results of this study showed that groups using prism training, or prism training with remedial reading, made no significant gains in achievement over that of the control group. The "placebo" and the "placebo with remedial" reading groups also showed no significant difference in achievement over the control group. Therefore, the null hypothesis that experimental treatments on the training groups would have no effect in reading achievement cannot be rejected on the basis of the data obtained in this experiment.

The usual statistical methods could not be used accurately to test the hypothesis that no difference in convergence ratings would appear between children who had had prism training and those who had not. Evidence was presented, however, which indicated that prism training as used in this experiment can successfully eliminate convergence insufficiency in the majority of children during an intensive six-week training period. In comparing the reading progress of the differential treatment groups with that of the control group, no significant difference could be established. It would appear from these data that little positive relationship exists between prism training and reading achievement.

It seemed reasonable to the writer to assume that failure

to establish this relationship may have been due to such situational factors as timing of the study near the close of the school year, the number of children in any one group under one teacher, and the length of the training period. A further reason is that visual difficulties may be coincidental with reading failure. The mere presence of visual anomalies does not justify the conclusion that they are causes of reading failure.

Evidence from this study should deter educators who are responsible for remedial reading programs from engaging in large-scale programs of eye training for the purpose of increasing reading achievement. Due to the highly complicated and interrelated nature of the reading process, it appears to be a waste of effort to attempt to discover single causation factors that hinder reading progress. Finally, in the opinion of the writer, educators should devote specific attention to diagnosing the individual child's reading needs. The extra teacher-attention necessary to focus on pupil difficulties may provide the added impetus for pupils to overcome their reading problems.

Microfilm \$2.00; Xerox \$4.80. 93 pages.

## AN ANALYSIS OF THE READING DIFFICULTIES OF RETARDED READERS IN SECOND, FOURTH, AND SIXTH GRADES

(L. C. Card No. Mic 59-3806)

Donna Janet Long, Ph.D. State University of Iowa, 1959

Chairman: Associate Professor William Eller

This study was conducted in the fourteen public elementary schools of Davenport, Iowa, in the spring of 1958.

Retarded readers were defined as second grade students whose composite scores on Primary Reading Profiles, Level One, fell within the lowest ten per cent of their grade throughout the city, and as fourth and sixth grade students whose scores on Test R of the Iowa Tests of Basic Skills fell within the lowest ten per cent of their respective grades throughout the city.

When the retarded readers were given the Lorge-Thorndike Intelligence Tests, Primary or Nonverbal Battery, it was found that the majority of the students in each grade obtained I.Q.s of 90 or above. The study population was comprised of thirty-four students randomly selected from the 90 or above I.Q. classification at each grade level and seventeen students randomly selected from the below 90 I.Q. classification at each grade level.

Five tests in the Durrell Analysis of Reading Difficulty were administered to the retarded readers. On the basis of their scores on several of these Durrell tests, the retarded readers were given the Gates Primary Reading Tests or the Gates Basic Reading Tests; Test One, Two or Three of The McKee Inventory of Phonetic Skill; an informal word analysis test or the Syllabication test in the Gates Reading Diagnostic Tests.

Retardation of at least one year for a second grade student, one and one-half years for a fourth grade student, and two years for a sixth grade student constituted a deficiency in the Durrell or Gates tests. Incorrect responses on at least one-fourth of the items constituted a deficiency in the informal test and the McKee Inventory.

The Chi-Square Test of Independence revealed a significant relationship between grade placement and deficiency in each of the Durrell tests. The per cent of students deficient in the Gates tests increased through the grades. The per cent of students deficient in the McKee Inventory decreased through the grades. The per cent of students deficient in the informal test and the Syllabication test remained high through the grades.

The Chi-Square Test of Independence revealed no significant relationship between I.Q. classification and deficiency in any of the Durrell tests.

The teachers of the retarded readers were asked to complete a Reading Checklist for each student. An analysis of Variance revealed a significant difference between teacher-estimated reading level and test-determined reading level of the students.

One limitation of the study is the fact that not all results were treated statistically for significance.

Within the limitations of this study the following conclusions were made:

- 1. The amounts of retardation in reading exhibited by retarded readers increases through the grades.
- Deficiencies exhibited by retarded readers in word recognition and word analysis are most frequent in the lower grades.
- Deficiencies exhibited by retarded readers in oral reading, silent reading, listening comprehension, and general comprehension are most frequent in the upper grades.
- 4. Retarded readers with I.Q.s below 90 have basically the same reading deficiencies as those students with I.Q.s of 90 or above.
- Teachers of retarded readers do not instruct the students on their appropriate reading levels. They overestimate the students' reading ability.
- Teachers of retarded readers are not aware of reading deficiencies at the grade levels where they most frequently occur.

Microfilm \$2.00; Xerox \$5.40. 107 pages.

### THE JUNIOR COLLEGE PROGRAM IN MATHEMATICS

(L. C. Card No. Mic 59-3206)

James Stuart McNair, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Edward A. Krug

The purpose of this study has been to identify the instruction in mathematics, if any, that should be included in the junior college curriculum to fulfill the accepted functions of the college and to meet the needs of all the

Study was made of the literature on the functions of the present-day junior or community college, the needs of the students, and the desired objectives of mathematics instruction. Conclusions as to whether or not any instruction in mathematics is essential in a junior college program of studies is based upon the findings of this investigation into the literature of these three areas.

The writers on the functions of the junior college generally agree that the college should offer curricula in the following areas: (1) preparation for advanced study, (2) vocational education, (3) general education, and (4) community service. The American Association of Junior Colleges has stated that the aim of all of the junior college curricula should be "to meet the needs of the student for maximum growth and development, to further his social maturity, and to enable him to make his greatest contribution as a member of society." The two-year program of studies should be planned to help the student realize his goals and the predicated goals of society. Training should be provided in these need-areas: (1) command of the fundamental skills of reading, writing, and quantitative thinking, (2) ability to communicate effectively in written and spoken language, (3) vocational competence, (4) civic competence, (5) physical and mental health, and (6) lifelong interest in learning and other worthwhile activities. Effective instruction in mathematics can and should help the student to realize his goals and the aims of junior-college education by (1) developing his accuracy and facility in the use of mathematical skills for functional competence. (2) developing the ability to do logical and critical thinking in mathematics and in life situations, (3) understanding the use of the common numerical symbols, including charts, graphs, elementary statistical presentations, and formulas, (4) learning to present quantitative information using the common symbols effectively, (5) understanding the elementary properties of plane and space figures of common occurrence in industry and life, (6) understanding basic procedures so that education may be continued into special fields of interest, and (7) developing an appreication of the contributions of mathematics to our culture and civilization.

Junior colleges have tacitly recognized that they have various functions, but have planned most of their curricula for the transfer students. There is need for a two-year terminal general education program if they are to fulfill their unique function in the educational system. Standardized tests show that many college freshmen are deficient in elementary mathematical competence as measured by the National Council of Teachers of Mathematics Checklist of twenty-nine items. Young people who are going into a technological society need further training in functional competence in essential mathematics for effective communication. Such a course would cut across traditional subject-matter lines and would provide the materials for effective instruction to correct the present deficiency in this area. One year of instruction in mathematics should be required of all junior college students, either in the university-parallel courses or in this new course, unless they can prove their competence on suitable test materials. Microfilm \$2.80; Xerox \$9.60. 214 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements  $5-1/2 \times 8-1/2$  inches, 4 cents per page. No postage is charged if check or money order accompanies order.

DEVELOPMENT OF AN INTEGRATED SCIENCE COURSE FOR AFFILIATED NURSING STUDENTS IN WASHINGTON JUNIOR COLLEGES

(L. C. Card No. Mic 59-3156)

Meribeth Jeanne Mitchell, Ph.D. State College of Washington, 1959

The purpose of this study was to analyze the basic science requirements in three non-collegiate, junior college affiliated, schools of nursing. An integrated science course for nurses was developed. This course was based on selection of science requirements by two groups of nurses.

The three schools of nursing in the state of Washington which are affiliated with junior colleges were chosen for the study. A checklist of items for possible inclusion in the outline from chemistry, microbiology, and anatomy and physiology was compiled. This checklist was submitted to four groups of respondents.

The Nurse Educators comprised those instructors in the three schools of nursing who taught in the following areas: nursing arts, medical nursing, surgical nursing, diet therapy, pharmacology, communicable disease, and obstetrics. By means of a rating scale, the Nurse Educators checked those items which they would like introduced to students before these students embark on the above seven courses. This rating scale also enabled the nurse to indicate the relative importance she attached to each item.

The Curriculum Consultants were composed of nurses known for their curriculum work and who represented all current types of nursing programs: shortened, diploma, and degree. They marked the checklist in relation to what they believed would provide ideal science preparation for a student's clinical study.

The group of Junior College Instructors consisted of those instructors in the three affiliated junior colleges who taught in the above science fields. They responded to the list in view of what they were currently including as subject matter in their class.

The Senior Students of all three schools of nursing marked the checklist indicating what they remembered as having been taught in the three respective courses.

A much shorter questionnaire was sent to graduates of all three hospitals who had been practicing one year. The graduates were questioned concerning the usefulness of their science courses and asked for specific suggestions for improving the offerings in the three areas.

Five intervals based on standard deviations were established and values for each item of the checklist based on standard scores were derived. On the basis of criteria established in the study, items were placed in one of three categories: items included by the nurses for the outline, items rejected by the nurses for the outline, and questionable items. The fate of the last group was determined mainly by a survey for use of the item in the textbooks used in the seven courses studied in each hospital.

There was agreement between the two nurse groups regarding inclusion or rejection of individual items, though they differed some in the amount of emphasis accorded them. The greatest difference of opinions were revealed between the junior college instructors and the nurses, with the junior college instructors tending to rate items as being more important than they were rated by the nurses. The most agreement between the nurses and the college instructors was found in microbiology, the least in anatomy and physiology.

The proposed course outline also included important physics principles and facts. Since none of the schools offered a physics course, the items for inclusion in this area were selected from a study of five textbooks covering physics in nursing.

The outline for the proposed course was based on the six topics listed in the Boston University Human Ecology course. The selected material from the four science fields was integrated and presented within the above framework.

Microfilm \$2.10; Xerox \$7.40. 160 pages.

### A COMPARATIVE STUDY OF RURAL AND URBAN GROUPS OF COLLEGE FRESHMEN

(L. C. Card No. Mic 59-985)

Jerry Myles O'Donnell, Ph.D. University of Alabama, 1958

This study was concerned with the problem of whether or not significant differences exist between rural and urban groups of college freshmen in regard to (1) personality, (2) scholastic achievement and aptitude, and (3) academic success in college. The hypothesis was made that significant differences do exist between the groups of rural and urban college students in these three variables. It was also hypothesized that significant differences exist in the variables between males and females within the rural and urban groups.

Subjects were selected from the entering freshman class of 1956 at the University of Alabama. According to four bases for classification which were established, only males and females who were graduates of "urban Alabama high schools" and "rural Alabama high schools" were included (a total of 679). Graduates of urban high schools were then divided into groups based on three categories of urban communities established by the U. S. Census of Population.

The Minnesota Multiphasic Personality Inventory was used to obtain information about the personality of each subject. The Cooperative School and College Ability Tests and the Cooperative English Test were used to measure the scholastic achievement and aptitude of the subject. Two methods were employed to indicate the degree of academic success in college achieved by each subject. First, quality point averages, as calculated by the University of Alabama, for the end of the first semester in the 1956-57 academic year were computed for each subject. Second, an investigation was made of the numbers of subjects in each group who were either placed on scholastic probation or dropped for poor scholarship by the University of Alabama at the end of their first semester.

Means and standard deviations were computed for the ten scales of the Minnesota Multiphasic Personality Inventory; for the Verbal, Quantitative, and Total scores of the Cooperative School and College Ability Tests; for the Total English and Total Reading scores of the Cooperative English Test; and for the University of Alabama quality point averages. The analysis of variance technique was used as a test of the significance of the differences among means. Variance ratios found to be significant in this analysis were tested for homogeneity of variance by Bartlett's test. The numbers of students placed on scholastic probation or dropped for poor scholarship were expressed

as percentages; the totals (or frequencies) were then analyzed by the chi-square test.

The major findings, which support the hypotheses, have been summarized as follows:

1. Personality: males and females differed significantly on nine of the ten scales of the Minnesota Multiphasic Personality Inventory; female scores tended to be more "normal" than male scores on each of these scales except the Social Introversion-Extroversion scale. Significant differences were found between rural and urban groups on only three of the scales (Hypochondriasis, Masculinity-Femininity, and Social Introversion-Extroversion). In general, scores of rural subjects tended to be more "normal" than those of urban subjects.

2. Scholastic achievement and aptitude: males and females differed significantly in Quantitative scores and in Total English scores; Quantitative scores of males were higher than those of females, whereas Total English scores of females were higher than those of males. Rural and urban groups differed significantly only in Total Reading scores; scores of urban subjects were considerably higher than scores of rural subjects.

3. Academic success in college: males and females differed significantly in the degree of academic success achieved in college. Females were found to be more successful than males during their first semester. Rural and urban groups did not differ significantly in the degree of academic success achieved in college during the first semester.

Microfilm \$2.00; Xerox \$5.20. 101 pages.

# THE RELATION OF SELECTED FARMERS' 4-H EXPERIENCE TO THEIR ADOPTION OF IMPROVED FARM PRACTICES

(L. C. Card No. Mic 59-3212)

Kenneth Sanford Olson, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Gale VandeBerg

### Problem:

Today, when the very survival of an individual farmer depends to some extent on whether or not he is able to adjust quickly to the rapid advances taking place in agriculture, it appears important that the activities of the Cooperative Extension Service, including 4-H Club work, be scrutinized in the light of its contribution to Extension's charge and task of helping farmers to adjust to changing situations. Systematic study in this area is limited.

Purpose:

The basic consideration of this study was to investigate the relationship between 4-H Club membership experience and improved farm practice adoption.

### Method:

The investigation included 103 pairs of farmers living in Barnes County, North Dakota. The respondents were initially selected on their ability to meet the following qualifications:

30 to 45 years of age inclusive Married

Farming continuously since 1954

Now lives on the farm being operated

Less than 100 days spent on an off-the-farm part-time job in 1957

Less than 25 percent of income from off-the-farm sources in 1957

They were also matched or paired on the following three control variables:

Farm size

Tenure

Formal education

Half the respondents had been former 4-H Club members and were identified as the experimental group. The other half had never been in a 4-H Club and were identified as the control group. Each respondent was interviewed by the author.

### Findings:

The major findings of the investigation indicated:

- That there was a statistically significant relationship between 4-H membership and the acceptance and adoption of the twenty-six improved farm practices included in the study.
- There was a significant relationship between the number of improved farm practices recalled as learned and used while in 4-H and the respondent's adoption of improved farm practices as well as his own 4-H membership tenure.
- 3. Differences between the experimental and control group concerning socio-economic, 4-H, and attitude characteristics included in the study were consistently in favor of the experimental group. Twenty-four differences favored the 4-H or experimental group, four were the same, and three were in favor of the control group.

  Microfilm \$2.30; Xerox \$8.00. 175 pages.

# SCHOOL POLICY IN STUDENT CHOICES OF COURSES IN HIGH SCHOOL MATHEMATICS

(L. C. Card No. Mic 59-3213)

Daniel Smith Parkinson, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Edward A. Krug

The purpose of this study has been to identify the bases and procedures used in four-year public high schools in the state of Wisconsin to assist students in making decisions concerning the selection of courses in the algebrageometry sequence, or general mathematics, or to take no course in mathematics in their high school careers. General mathematics is taken to mean a course including advanced arithmetic topics and applications of these such as insurance or budgets. The population of this study is contained in 166 four-year Wisconsin public high schools, offering courses in both algebra and general mathematics, and allowing students to choose between these courses during their high school careers. Two questionnaires were sent to these schools, the first for the principal or

director of guidance, and the second for the head of the department of mathematics. In seven schools, interviews were held with the persons who filled out the questionnaires, and a special questionnaire was filled out by one class each in algebra and general mathematics regarding the students' reasons for taking their present mathematics course and who had influenced them to take this course.

Almost twice as many students were taking algebra as were taking general mathematics. Schools with a college-preparatory track tended to enroll a larger proportion of students in elementary algebra in the ninth grade, while schools without this track enrolled a larger proportion in this subject in grades ten through twelve. Schools without a college-preparatory track tended to enroll a larger proportion of students in general mathematics in the ninth grade, while schools with this track enrolled a larger proportion in grades ten through twelve. Although a higher proportion of ninth grade students entered the algebrageometry sequence in schools with college-preparatory tracks, the proportion of tenth grade students taking plane geometry was almost equal for schools with and without a college-preparatory track.

In over 95 percent of the schools two semesters of unspecified mathematics were required of all students for graduation. In the 57.2 percent of the schools that had college-preparatory tracks, 70 percent required at least four semesters of mathematics of college-preparatory students. Algebra and geometry were often required of these college-preparatory students also.

The most important items in school policy for the guidance of students in mathematics, as reported by the principal or director of guidance, were "score mathematics," "reports from the eighth grade teacher," and "I. Q. score." Schools without a college-preparatory track tended to give greater importance to test scores than did schools with this track, while the latter appeared to give almost equal importance to several items.

In a questionnaire directed to the heads of departments of mathematics most of these persons agreed that algebra and geometry are valuable courses for all students who can succeed in them, and that general mathematics is a course for the residuum. Disagreement existed concerning whether general mathematics should be a preparatory course for later work in algebra. They appeared to think that ability, motivation, and college-preparatory status were important items for student guidance in mathematics.

Responses of students whose opinions were requested indicated that factors outside of the school were important in influencing student choices of courses in mathematics, of which the parents were most important.

Microfilm \$3.85; Xerox \$13.00. 300 pages.

# EVALUATION OF THE STUDENT TEACHING PHASE OF BUSINESS TEACHER PREPARATION

(L. C. Card No. Mic 59-3365)

Loy Elvin Prickett, Ed.D. The University of Oklahoma, 1959

Major Professor: Gerald A. Porter

The problem of this study was to determine sound basic principles of student teaching and to apply them in the

formulation of an evaluative instrument. The evaluative instrument was designed for the specific purpose of measuring the effectiveness of the student teaching phase of business teacher preparation. The study consisted of three phases: (1) analysis and interpretation of available literature to facilitate definition of basic principles applicable to student teaching, (2) determination of specific criteria essential in the evaluation of student teaching as preparation for business teachers, and (3) preparation of an evaluative instrument.

Fourteen concisely-stated fundamental principles of student teaching were developed and categorized in relation to seven significant aspects of student teaching. Numerous criteria to be used in evaluating all phases of student teaching programs in business teacher preparation were established. The significant aspects of student teaching, the fundamental principles involved in each aspect, the rating scales, and the criteria were combined and stated in seven schedules to form the evaluative instrument.

The evaluative instrument has usefulness for professional personnel in evaluation of the student teaching phase of business teacher preparation. It may be used chiefly for self-evaluation purposes or it may be used in determining the extent to which standards of a regulating body are satisfactorily met. The basic intent in preparation of the evaluative instrument was to aid in bringing about improvement in programs of student teaching in business education regardless of the levels at which they are currently maintained.

Conclusions reached:

- 1. There are certain fundamental principles applicable to student teaching that should be substantially adhered to at all times and in all phases of the operation of student teaching programs.
- 2. It is possible to develop appropriate criteria and satisfactory evaluative techniques to be used in determining the extent to which student teaching functions effectively as a part of the preparation of future teachers of business subjects.
- 3. The evaluative instrument entitled: "Criteria for Evaluation of Student Teaching in Business Education," as presented in the research report should be utilized to bring about general improvement in student teaching in business education.

Microfilm \$2.55; Xerox \$9.00. 196 pages.

READABILITY OF SOCIAL STUDIES TEXTBOOKS FOR GRADES FOUR, FIVE, AND SIX, AS MEASURED BY THE DALE-CHALL FORMULA

(L. C. Card No. Mic 59-3500)

Fred A. Sloan, Jr., Ed.D. George Peabody College for Teachers, 1959

Major Professor: Harold D. Drummond

The major purpose of this study was to determine the readability level of each book in seven series of social studies textbooks prepared by selected major publishers for use in Grades 4, 5, and 6. The textbooks analyzed were either history books or a "fused" type of presentation.

Through the application of the Dale-Chall Formula, a final grade placement level was determined for introductions; content; and questions, activities, and projects in each social studies textbook analyzed. A general grade placement was calculated for each of the textbooks.

An analysis of variance was made to test the hypothesis that the readability means within each social studies series were distributed along a line which was not significantly different from the theoretical standard line of progression, based on the assumption that readability scores for a series should begin at 4.0 at the fourth-grade level and gradually increase to 6.9 by the end of the sixth grade.

# Findings

1. Eleven of the twenty-one social studies textbooks analyzed had general grade placements which coincided with the grades to which they were assigned by the publishers. Three of these eleven were fourth-grade textbooks; two were fifth-grade textbooks; and six were sixth-grade textbooks.

2. Ten of the textbooks contained introductory material with final grade placements at the grade levels for which the textbooks were prepared. Four of these ten were fourthgrade textbooks; three were fifth-grade textbooks; and three were sixth-grade textbooks.

3. Only two fourth-grade textbooks had levels of readability for content at the fourth-grade level. Three fifth-grade textbooks and four sixth-grade textbooks also had appropriate readability levels for content.

4. At no grade level were there more than three textbooks which had appropriate levels of reading difficulty for questions, activities, and projects materials.

5. In most textbooks the majority of the readability scores was not concentrated at the grade level to which the book was assigned by the publisher, the scores being distributed over a wide range.

6. Readability scores for introduction in the series published by The Macmillan Company and Ginn and Company were found to be distributed along a line which is not significantly different from the theoretical standard line of progression from 4.0 to 6.9. The same hypothesis was found to be tenable at the 1 per cent level for scores derived from content in the series published by The Macmillan Company. The hypothesis was untenable for scores for questions, activities, and projects in all series. The statistical analysis supports the conclusion that there is little continuity within and between textbooks of the series.

### Recommendations

1. Publishers of social studies textbooks shown by this study to have inappropriate general grade placements should bring the reading levels to the appropriate grade levels through control of sentence length and proportion of uncommon words.

2. Improvement of the readability of introductory material is needed in most of the social studies textbooks analyzed and especially in those for the fifth and sixth grades.

3. Attention should be given to improving the readability of content in many of the textbooks analyzed and especially in those written for the fourth grade.

4. The readability of questions, activities, and projects should be improved in most of the textbooks analyzed and at all grade levels.

5. Effort should be made to provide a gradual and uniform rate of increase in reading difficulty, beginning at 4.0 at the fourth-grade level and reaching 6.9 by the end of the sixth grade.

Microfilm \$6.15; Xerox \$21.40. 481 pages.

# EXPERIMENTAL EVALUATION OF A METHOD OF TEACHING ENGLISH COMPOSITION

(L. C. Card No. Mic 59-5577)

Carl E. Wagner, Ed.D. University of Kansas, 1956

The method of teaching evaluated in this study is called the four-point method. The writer has applied it in high school mathematics classes, college education classes, and as an administrator has assisted others in applying it to several grades and different high school courses. The four points of the method are: (1) Prepare each assignment upon the same size of paper. 8 1/2 by 11 inch paper became standard. (2) Save all papers in chronological order. (3) Have all assignments bound into permanent book form at the end of the course and present this book to the parents of the student. (4) Reproduce the better work to be used as visual aid material for both the present class and for subsequent classes of students who might take the course.

### **PROCEDURES**

To evaluate the four-point method it was applied to the teaching of English Composition writing. The procedures were determined by two questions to be answered. These questions were:

Will a group of students who were taught by the fourpoint method during the two semesters of their Freshman English course and the first semester of their Sophomore English course write better English Compositions than another group of students who were taught by conventional methods during the two semesters of their Freshman English course and the first semester of their Sophomore English Course?

Will a second experimental group of students who were taught by the four-point method during the first semester of their Freshman English course write better English Composition than the first experimental group of students who were also taught by the four-point method during the first semester of their Freshman English course the previous year?

The answer to the first question involved the use of both a control and an experimental group. Both of these groups were studied for three semesters. The answer to the second question involved the use of two experimental groups. The first experimental group was identifical to the experimental group in the three semester study, but only the compositions written at the beginning and end of the first semester were considered. The second experimental group was drawn from the next generation of Freshman students. The third semester of the three semester study and the second experimental group were conducted simultaneously.

Materials used in the evaluation of compositions written

in this experiment included: Hudelson's Typical Composition Ability Scale, the Index of Subordination, and Thorndike's spelling credit numbers.

Using these tools the following procedures were employed to answer question one:

- 1. A rural high school of 140-150 students in Central Illinois was selected as the school in which to conduct the experiment because of the homogeneous background of the student body.
- 2. The same teacher was used for both the experimental and control groups.
- 3. Early in the experiment, three graders were carefully trained on the materials presented in Hudelson's Manual of Teachers to insure consistent marking of the compositions.
- 4. The 1954 Freshman class of 58 students was divided in a random manner into two groups.
- 5. The one group of 29 students became the control group and was taught by conventional procedures.
- 6. The other group of 29 students became the experimental group and was taught by the four-point method.
- 7. The Otis Quick Scoring Test of Mental Maturity was administered to both groups. For computational purposes the raw scores were used.
- 8. During the first week in September, both groups wrote compositions on three Hudelson topics. The directions relevant to those particular topics were closely followed. The mean Hudelson grade of the three compositions became the initial or pre-test Hudelson score for the students in the two groups. The Hudelson score assigned to all other compositions in this experiment was the mean of the grades assigned by the three graders.
- 9. The Index of Subordination was applied to the same three compositions. The mean Index became the initial or pre-test index of writing maturity for the students in the two groups.
- 10. The spelling mistakes in the compositions written on these three Hudelson topics were referred to Thorndike's 10,000 word list. The mean of the total credit numbers for the words misspelled became the initial or pretest spelling score for the students in the two groups.
- 11. The three measures mentioned in steps 8, 9, and 10, were regularly applied to each of the compositions written during this experiment. The three measures applied are, in fact, three parallel studies. A student's Hudelson score is always a mean of three Hudelson grades on three separate compositions; his writing maturity index is always the mean of three writing maturity indexes earned on three separate compositions; and his spelling score is always the mean of three spelling grades earned on three different compositions.
- 12. The initial scores mentioned in steps 8, 9, and 10 served as the pre-test scores for the three semester study. These same scores for the experimental group served as pre-test scores for the one semester study in which two experimental groups were compared. At the end of the first semester, the students in the experimental group wrote compositions on three other Hudelson topics. The mean of these grades became the post-test scores for a study of the one semester experiment.
- 13. At the end of the third semesters, students of Group A and Group B wrote on three more Hudelson topics and the mean of the grades assigned to these compositions served as the post-test scores for the three semester experiment.

Materials used in the evaluation of compositions writt

14. Analysis of variance and covariance were applied to the final Hudelson Scores, the final Indexes of Subordination, and the final spelling scores for the two groups, A and B, which had been studied for three semesters.

To answer the second question, only one more group was needed. The extra group was the second experimental group, Group C. Group C was studied for one semester. The compositions written by Group C were compared with the compositions written by Group B during the first semester of this investigation. Both of these groups were taught by the four-point method. The primary difference between the instructional programs was that Group C had the best work of Group B as visual aids. All measures taken for the three semester study were taken for the three semester study were followed for this one semester study.

Since there are two separate studies with three measures for each, there are six comparisons that are made which indicate six analyses of variance and covariance. The conclusions listed are directly related or derived from the null hypotheses used in the analyses of variance and covariance.

### CONCLUSIONS

Before the two general questions about which this study was framed can be answered, the conclusions which have statistical validity and verification are presented. The following six conclusions are the results of the statistical analysis.

- 1. In the three semester study a group of students who were taught by the four-point method during the two semesters of their Freshman English course and the first semester of their Sophomore English course wrote better English Compositions as measured by Hudelson's Scale than another group of students who were taught by conventional methods for an identical period of time.
- 2. In the three semester study a group of students who were taught by the four-point method during the two semesters of their Freshman English course and the first semester of their Sophomore English course wrote more mature Compositions as measured by the Index of Subordination than another group of students who were taught by conventional methods for an identical period of time.
- 3. In the three semester study a group of students who were taught by the four-point method during the two semesters of their Freshman English course and the first semester of their Sophomore English course wrote compositions no better in spelling as measured by Thorndike's credit numbers than those written by another group of students who were taught by conventional methods for an identical period of time.
- 4. In the one semester study a second group of students who were taught by the four-point method during the first semester of their Freshman English course wrote no better English Compositions as measured by the Hudelson Scale than the first group who were taught by the four-point method for an identical period of time.
- 5. In the one semester study a second group of students who were taught by the four-point method during the first semester of their Freshman English course wrote no more mature compositions as measured by the Index of Subordination than the first group who were taught by the four-point method for an identical period of time.

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6. In the one semester study a second group of students who were taught by the four-point method during the first semester of their Freshman English course wrote compositions better in spelling as measured by Thorndike's credit numbers than the first group who were taught by the four-point method for an identical period of time.

From these six conclusions answers to the two ques-

tions presented in this study are drawn:

1. Students who are taught by the four-point method during the two semesters of their Freshman English course and the first semester of their Sophomore English course wrote better English Compositions than another group of students who were taught by conventional methods for an identical period of time.

2. There is little evidence that the effects of the fourpoint method are cumulative so that a second year group would write better English Compositions than a first group

the previous year.

# IMPLICATIONS OF THE STUDY

Considering the long history of the four-point method, its evaluation in the one semester study of this investigation may not have been extended over a long enough period of time to warrant anything but a tentative conclusion. Since the three semester study indicated that the four-point method was of value, this writer believes that a study of greater length than one semester is needed before any final judgment can be made concerning the efficacy of the four-point method in constantly improving the work of succeeding generations of students.

Microfilm \$2.45; Xerox \$8.60. 187 pages.

# EDUCATION, ADMINISTRATION

RELATIONSHIPS BETWEEN COUNTY-WIDE MEASURES OF CERTAIN SOCIO-ECONOMIC FACTORS, INTELLIGENCE, AND ACADEMIC ACHIEVEMENT OF HIGH SCHOOL SENIORS IN FLORIDA

(L. C. Card No. Mic 59-3538)

Samuel Sandy Bottosto, Ed.D.
The University of Florida, 1959

Purpose of the Study:

The purpose of this study was to investigate the relationships between county-wide measures of certain socioeconomic factors, intelligence, and academic achievement of high school seniors in Florida.

Measures of county-wide socio-economic, intelligence, and academic achievement levels were developed for the white, nonwhite, and total population of each county represented in the study. Quantified census data relating to the median years of school completed by persons 25 years old and over and median annual family income were used to develop measures of socio-economic levels for the counties included in the study. The measures of county-wide intelligence and academic achievement levels were developed from the individual test scores made by 24,026 high school seniors who participated in the Florida State-Wide Twelfth-Grade Testing Program during the years 1956 and 1957.

Design of the Study:

The basic techniques for making the statistical analyses were as follows: The transforming of income and schooling figures into T-values, the transforming of median raw intelligence and academic achievement test scores into comparable scaled scores, the computation of simple (Pearson Product-Moment) correlations among all the variables in the study, the computation of partial and multiple correlations in terms of those variables which were found to be critical factors in arriving at answers to the basic questions in the study, and the testing of the significance of the calculated correlations by the use of Snedecor's tabled values of R and r at 1 and 5 per cent levels.

### Conclusions:

The major findings of this study indicated that:

1. Achievement of white high school seniors in English, social studies, natural science, mathematics, and total achievement is significantly related to the socio-economic factors of adult schooling and family income of the white population in Florida counties.

2. Achievement of nonwhite high school seniors in English, social studies, natural sciences, and total achievement is significantly related to the socio-economic factors of adult schooling and family income of the nonwhite popu-

lation in Florida counties.

Achievement of nonwhite high school seniors in mathematics is negligibly related to the socio-economic factors
of adult schooling, income, and the measure of schooling
and income combined.

- 4. The county-wide socio-economic factors of schooling and income appear to be more closely associated with achievement in English and social studies than with natural science and mathematics.
- 5. Achievement in mathematics for the nonwhite population appears to be the only measure of achievement which is negligibly related to size of county.
- The greater the proportion of nonwhites in a county, the lower the academic achievement of nonwhite high school seniors in that county.
- 7. The relationship between intelligence and achievement in English for the nonwhite high school seniors approaches the relationship between the measure of intelligence and English for the white high school seniors more closely than for any other measure of achievement.
- 8. When the measures of intelligence and size of county are held constant, socio-economic factors of schooling and income are still found to be significantly related to total academic achievement for the white and nonwhite high school seniors in Florida counties.

Microfilm \$2.90; Xerox \$10.00. 224 pages.

# A SCHOOL PLANT FACILITIES PLAN FOR CONNELL SCHOOL DISTRICT, STATE OF WASHINGTON

(L. C. Card No. Mic 59-3148)

Joseph William Chatburn, Ed.D. State College of Washington, 1959

The purpose of this study was to look ahead with reasonable certainty to the completion of United States Bureau of Reclamation land development in the Connell School District and determine the total number of school-age children

for whom educational facilities will be needed. It was felt that new facilities should be located with full knowledge of the population at saturation and some idea of where the children would be living. To arrive at such a projection it was necessary to:

- Determine the total number of farm units expected in the district when land development will have been completed.
- 2. Determine the number of farm units being farmed at the time this study began.
- Determine the number of farm families having schoolage children and the number of school-age children per family.
- 4. Establish a ratio of total number of farm families with school-age children to total farm units being farmed.
- 5. Use an established ratio of rural school children to urban school children.

Data were collected by observation, visitation, and the distribution and collection of survey questionnaires. Students distributed and collected questionnaires from all families having school-age children. Questionnaires were mailed to all other residents and nonresidents of the school district owning farm units in the school district. A brief historical background of the Connell School District, the two community centers of Connell and Mesa, and the Columbis Basin Area is included in this study.

The Connell School District contains approximately 500 square miles of land. Bureau of Reclamation land development, starting in 1948, resulted in rapid population growth. In the ten years from 1949 to 1959 school enrollments increased from 162 to 616 students. The 1958-1959 enrollment represented children from only 169 of the total 1,483 potential farm units in the school district. It was found that 66 per cent of all farm units under cultivation would be occupied by families with school-age children. Application of this percentage to the 1,483 potential farm units established the fact that 983 families with school-age children may be expected to be living on farm units in the district when land development will have been completed. Data revealed that each farm family with school-age children would average 2.19 school-age children. The saturation population projection of rural school-age children was 2,158.

A four to five (rural to urban) ratio established by previous studies, applied to the 2,158 rural students indicated that 2,698 urban students may be expected, making a total of 4,856 students enrolled in the Connell School District schools at saturation.

The results of the study indicate:

1. Saturation planning allows a school district to meet present school facilities needs as well as those of the future by placing schools near the center of service areas based upon complete development.

2. Certain identifiable trends which remain operative and are verified within a school district may be used as a

basis for projecting saturation population.

3. A long-range educational program should be developed in the Connell School District utilizing school personnel, people of the district and school children.

4. A major decision is needed regarding one or two high schools before a high school is built.

5. Five service areas, each with a five mile radius, will help establish the most advantageous locations for elementary schools.

6. School sites should be acquired in the near future

for each of the proposed schools.

7. Elementary schools may be built in basic modules of six, seven, eight or ten classrooms as the need becomes apparent; however, the central core of the building should be large enough to care for future additions.

Microfilm \$2.00; Xerox \$6.20. 128 pages.

# A STUDY OF THE OKLAHOMA EXTENSION DIVISION WITH EMPHASIS ON HOME DEMONSTRATION WORK

(L. C. Card No. Mic 59-3179)

Sohinder Jit Chopra, Ph.D. The University of Wisconsin, 1959

Supervisors: Professors Robert C. Clark and Julia I. Dalrymple

### Problem and Objectives

The extension program in the United States is the result of much trial and error on the part of the personnel involved. An understanding of the development and functioning of a single program should provide some guidance for those who assume a comparable responsibility in less experienced countries. Oklahoma represents a state where much pioneering work was done through the years toward the establishment of a satisfactory program. An attempt is made in this study to find the answer to the major question: What are the organizational structures, nature of the program, and personnel management policies of a representative State Extension Service with emphasis on Home Demonstration Work? The major objective was to determine the extent to which the Oklahoma Extension Division conforms to certain principles of administration which were established as the theoretical frame of reference for the study.

### **Procedures**

The descriptive case study technique was used. The writer spent ten weeks in the state during the fall of 1957 interviewing fifty-six members of the extension staff at the state and county level.

Data were also collected and analyzed from pertinent written materials such as official records, annual reports, historical statements, correspondence, memorandum of

understandings, and other documents.

### Conclusions

Conclusions were drawn using the stated principles of administration as a frame of reference.

- 1. The staff of the Oklahoma Extension Division is organized in a hierarchial arrangement with vertical lines of authority and responsibility.
- 2. Levels and areas of authority and responsibility are, in general, clearly defined and understood by all personnel in the organization.

- The Oklahoma Extension Division is not at all consistent as to the span of control, and has not defined the limit for any supervisor.
- 4. Various tools of communication, with the exception of a handbook, are available to the Oklahoma Extension Division. For various reasons, however, they are not always fully and effectively used in the horizontal and vertical communications within the organization.
- 5. The subject-matter programs of extension specialists are not fully coordinated with the research and resident teaching functions of the Oklahoma State University. The extension specialists are responsible to the Director of extension for budgets and administration and to the heads of the departments for subject-matter.
- Personnel are involved in the decision-making process when the administration deems it appropriate; they are not involved when it is felt to be inappropriate.
- 7. The Oklahoma Extension Division engages in numerous in-service training activities. The training opportunities provided appear to be adequate, except for the top levels of the hierarchy.
- The Oklahoma Extension Division does not provide clear-cut job descriptions and standards of performance for each position as a basis for job evaluation.
- The Oklahoma Extension Division fails to provide clearly defined salary and promotion policies for its staff.
- 10. General policies and procedures have been developed for program planning to encourage participation by local people and professional staff, but such policies and procedures have not been fully and generally followed.

Microfilm \$3.60; Xerox \$12.20. 277 pages.

# THE PROFESSIONAL STATUS OF THE TWELVE-GRADE PRINCIPALS OF LOUISIANA

(L. C. Card No. Mic 59-3037)

William Miles Crow, Ed.D. University of Arkansas, 1959

Major Professor: Roy B. Allen

Purpose of the study. The purposes of this study were to determine the professional status of the twelve-grade principals of Louisiana and to make suggestions and recommendations for improving their status. The main areas of inquiry were educational preparation, experience, and in-service improvement.

Method of research. Information blanks were mailed to all 269 twelve-grade principals of Louisiana. Data from the 260 usable information blanks were compared with other studies and the criteria recommended in current professional literature.

Summary and conclusions. The median Louisiana twelve-grade principal completed his undergraduate work in 1938, and he received a master's degree in education from Louisiana State University in 1951. It has been five years since he was enrolled in a college course, but he has earned 18 graduate hours since becoming principal. He has completed a total of 5.8 years of college education.

His school enrolls 351 pupils and employs 16 teachers. His work day at school lasts nine hours, including one period of classroom teaching. His annual salary is \$7,077. Neither an assistant principal nor a secretary are provided in most schools.

He has been in educational work for 22 years, including 9 years at his present position. Before becoming principal, he served several years as high-school coach and/or teacher.

Each week he spends about four hours on professional improvement. Membership is maintained in four professional education associations, including one local, one state, and one national organization. Each year he attends eight parish principals' meetings, a two-day parish-wide workshop, and the state education association convention; yet he has never attended a meeting of a national education organization. The local meetings are the only ones that provide much help to him in his work. The parish supervisory staff is his main source of professional aid.

The median principal regularly reads five professional magazines and read three educational books during the past year. He made two speeches about education last year. Also, he participated in two visitations to other schools during the past five years. It is very unlikely that he has ever written an article for publication.

His education, experience, and in-service growth indicate that the Louisiana twelve-grade principal is vitally interested in the principalship as a professional career. He compared favorably with public-school principals of other studies in a large majority of the factors investigated. However, when the status factors of these principals were compared with the recommended criteria, there was room for improvement on most items.

Recommendations.

- 1. A state-wide salary schedule should be adopted for all Louisiana principals.
- 2. Principals should be relieved of all scheduled classroom teaching.
- 3. The principal should be provided with one full-time assistant principal and a clerical worker for each 500 pupils enrolled in the school.
- 4. Certification requirements should be revised to require training in both elementary and secondary administration and supervision.
- 5. School boards should provide funds for the attendance of professional meetings by the principal.
  - 6. Principals should be employed for twelve months.
- 7. Principals should join the state and national principals' associations and the National Education Association.
- 8. School boards should provide funds for maintaining a professional library in every school.
- 9. Principals should allot more time to in-service activities.
- 10. Principals should make more use of the available resource personnel.
- 11. Elementary departments should be evaluated in all twelve-grade schools.

12. The parish-wide workshops should be extended and include all school personnel.

Microfilm \$2.00; Xerox \$7.20. 151 pages.

# THE EFFECT OF INSTRUCTION IN PUBLIC EDUCATION ON PUPIL AND PARENT INFORMATION AND ATTITUDES

(L. C. Card No. Mic 59-3062)

John Dunworth, Ed.D. University of Southern California, 1959

Chairman: Professor Stoops

The purpose of this study was to determine the effect of instruction in public education on the information and attitudes, as related to public education, of selected groups of eighth grade pupils, to ascertain whether such instruction affected the information and attitudes of the parents of these pupils, and to note the effect of such instruction on pupil attitude toward teaching as a possible vocation.

The problem was approached through the use of a conventional experimental design. An information test and an attitude test were administered to a control group and an experimental group, and to a random half of the parents of the pupils in these groups, at the beginning of a period of instruction. The same instruments were readministered to both pupil and parent groups at the close of the period of instruction about public education. Gains made by the experimental pupil and parent groups which could not be attributed to certain cognitive and environmental factors were studied as possible experimental evidence of the efficacy of the instruction in public education.

Findings. (1) Both control and experimental pupil groups made significant information gains, but those of the experimental group were significantly greater. (2) The gain in information made by the parents of the experimental group was significantly greater than that made by the parents of the control group. (3) With respect to pupil attitudes, the difference between the two groups on the attitude posttest was significantly in favor of the experimental group, although the gain made by the experimental group, when compared with that made by the control group, was not statistically significant. (4) Further analysis revealed that a significant difference occurred in attitude gain between the control and experimental groups, as measured by the critical item referring to pupil interest in teaching as a vocation. The difference favored the experimental group. (5) The difference between parents of the control and experimental groups on attitude gain was not significant, although the parents of the experimental group showed a greater attitude gain than did the parents of the control group. (6) Information gain, and pupil attitude gain as measured by the critical item referring to pupil interest in teaching as a vocation, could not be explained as a function of any of the following seven factors: pupil's intelligence, quotient, reading grade placement, chronological age, number of years pupil attended school in district, or in state, father's occupational status, or father's education.

Conclusions. (1) Instruction in public education is effective in terms of increasing pupil information about public education. (2) Instruction in public education is effective

in terms of modifying pupil attitude toward teaching as a possible vocation. (3) Instruction in public education is effective in terms of increasing parent information about the public schools. (4) If attitudinal patterns of boys and girls are to be modified in the direction of an understanding and appreciation of public education, it would seem advisable to commence instruction at an early age. (5) The resource unit used in this study is demonstrably effective as an aid in the teaching of public education.

Recommendations. (1) School districts should initiate the teaching of public education. (2) Such instruction should be begun at an early age. (3) Instruction in public education should be continuous and recurring throughout the child's total school experience. (4) In establishing good homeschool-community relationships, the planning of instruction in public education should take into account the importance of the child as a public relations agent. As such, his knowledge about public education should not be the result of casual or accidental learnings, but should be the result of a carefully structured series of instructional experiences.

Microfilm \$3.20; Xerox \$10.80. 245 pages.

# A STUDY OF INSTRUCTIONAL SUPERVISION IN LOUISIANA'S PUBLIC ELEMENTARY SCHOOLS

(L. C. Card No. Mic 59-3493)

William Ray Eglin, Ed.D. George Peabody College for Teachers, 1959

Major Professor: Harold D. Drummond

The purpose of this study was to determine the nature and status of instructional supervision in the elementary schools of Louisiana's sixty-seven public school systems, to show the development of supervision in the state, to obtain an evaluation of Louisiana's instructional supervision programs in terms of nine characteristics of good supervision, and to make recommendations concerning the improvement of the programs of supervision in the public elementary schools in the state of Louisiana.

Data concerning the general and professional preparation of instructional supervisors and information relative to the effectiveness of supervisory functions which they performed were obtained by questionnaires. Additional data were obtained from interviews with a sample of one hundred teachers in five selected Louisiana parish school systems, and from interviews with the supervisory personnel of the same systems. Finally, to support the findings, comments on instructional supervision in Louisiana's public elementary schools were obtained by letter from a group of fifteen selected, leading Louisiana educators.

The significant findings revealed in this study were as

1. A large majority of instructional supervisors in Louisiana's public elementary schools were qualified and experienced educators who were actively engaged in inservice activities involving teachers and themselves.

2. Approximately one-half of the supervisors had from one to four or more extra duties to perform. They were often handicapped in their efforts to improve learning by weak teachers under tenure. Furthermore, a large supervisor-teacher ratio and/or a large teacher-pupil ratio hindered efforts.

3. Supervisors indicated that of forty-seven supervisory functions which they performed, eleven were not helpful and twenty-six were helpful in improving instruction. Thirteen of the highest ranked functions performed by the respondents were those reported in a previous study as having been performed most frequently or regularly by educators across the nation. The functions generally involved participation in professional organizations, assisting teachers to solve problems through individual conferences, classroom visitations, group conferences, and the use of workshops and worktype meetings.

4. Supervisors, teachers, and the selected, leading Louisiana educators recognized a need for additional supervisory personnel. In four of the sixty-seven school systems in Louisiana, no supervisors were employed.

5. The need for better public relations, continuous evaluation of instruction and supervision, and a change in the teacher tenure law was indicated.

6. Instructional supervision in Louisiana's public elementary schools was based on democratic leadership, assistance on a consultative basis, and services involving materials and resources.

The recommendations listed herewith were those made for the improvement of instructional supervision in Louisiana's public elementary schools:

1. Each of the sixty-seven parish school systems should have the services of a supervisor. In those systems where supervisors were employed and wherein supervisor-teacher and teacher-pupil ratios were high, additional supervisors should be employed.

2. Instructional supervisors should be released from all nonsupervisory responsibilities.

3. Certification requirements for supervisors should be specific with regard to courses to be taken, and redefined to prevent conditional employment of supervisory personnel.

4. The organized teaching profession in Louisiana should take the lead in revising the provisions of the teacher tenure law.

5. More parish school systems should encourage and provide for action research in supervisory programs.

6. An organized program of instruction in testing and evaluation should be a part of all annual supervisory programs at the parish level.

7. All education personnel in the state should participate in workshops or worktype meetings designed to improve community-school relations.

Microfilm \$4.05; Xerox \$13.60. 314 pages.

# THE ORGANIZATION AND OPERATION OF EXTENSION MARKETING PROGRAMS IN SELECTED STATES, 1957

(L. C. Card No. Mic 59-3185)

Jean Charles Evans, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Bryant E. Kearl

This study was designed primarily to develop a body of knowledge about the characteristics of people, policies, and administrative organizational structure associated with educational programs in marketing carried on by the Cooperative Extension Services of eight states: Ohio, Michigan, New York, Georgia, California, North Carolina, Delaware, and Pennsylvania.

The specific purposes of the study were to: (1) identify, describe, and analyze the characteristics, both single and compositely, of (a) the administrative organizational structure of the Cooperative Extension Service in each state as it was related to marketing personnel and their educational programs, and (b) the program operational procedures, policies, and methods; (2) ascertain what problems existed in these educational programs and why such problems occurred in some states and not in others; and (3) develop a set of recommendations which, if followed, would reduce the probability of problems occurring, reduce the severity of or correct those which already exist, or eliminate some problem entirely.

Individual personal interviews were conducted, using open-ended questions, with 286 individuals in the following categories: (1) all available Extension personnel listed on every Agricultural and Marketing Act project, including specialists, marketing agents, consumer information agents, and others, (2) administrators such as directors of Extension, assistant directors, supervisors, department heads, and others; (3) administrators of Experiment Stations; (4) deans of the colleges of agriculture and home economics; (5) county Extension personnel in counties where marketing agents were located; (6) representatives of the clientele and of professional communications channels.

The analysis revealed: (1) a widespread lack of overall program planning by anyone at the state administrative staff level; (2) predominant attention being given to specific groups of clientele rather than to specific problems regardless of clientele; (3) a general dissatisfaction by marketing specialists with having to conduct their educational programs through county Extension offices; (4) little serious concern about the particular administrative structure in the state; (5) general discontent by specialists with the amount of research information available, but a generally inadequate effort being made to locate what was available; (6) the continuing employment of personnel inadequately trained and experienced for assignments being made; (7) little attention being given to the development of preservice or in-service training; (8) the existence of many problems where generalized rather than specific assignments were being made; (9) variable success with the use of lay advisory committees; (10) little attention being given to evaluating results of programs except in terms of activity; (11) a high degree of generality and low degree of specificity in statements of objectives when objectives were stated; and (12) a low level of knowledge of how to develop a set of clearly stated, specific objectives.

Microfilm \$2.75; Xerox \$9.60. 212 pages.

### EVALUATION OF PERFORMANCE OF SENIOR HIGH SCHOOL TEACHERS

(L. C. Card No. Mic 59-3326)

Wilfred Edwin Gunderson, Ed.D. University of Washington, 1959

Chairman: George D. Strayer, Jr., Ph.D.

The general purpose of this study was to determine the feasibility of developing evaluative procedures and instruments appropriate for use in secondary schools. Evaluation of performance of teachers was considered worthwhile primarily because of its potential contribution to the professional growth of teachers through providing them with specific behavioral goals.

Seventeen teachers in one high school participated in formulating criteria of teaching effectiveness and in revising these criteria after they had evaluated themselves, had been evaluated by the principal, and had been rated by

high school pupils.

The revised evaluative instrument used by administrators and teachers consisted of thirty-one brief, positive descriptions of teacher behavior with space after each item for indicating three levels of performance. Pupils rated teachers on the first twenty-four of these thirty-one items. Items pertained to arousing interest, to making meaning clear, to providing for pupils of different ability levels, and to maintenance of orderly conditions and cooperative relationships.

The evaluative procedure involved completion of a selfevaluation form by each teacher, completion of an anonymous rating form for each teacher by each of his pupils (which was then given to the teacher), completion of an evaluation form by the administrator for each teacher, and a post-evaluation conference between each teacher and his administrator. This study did not include an appraisal of these conferences.

One hundred two teachers (including the seventeen who helped select the criteria) in twelve high schools in the northwestern part of the State of Washington participated in the study. The number of rating forms completed by pupils was 7233. Participation of teachers was voluntary; therefore inferences concerning non-participating teachers were not justified.

Teachers of all secondary school subjects were willing to agree upon about thirty brief descriptions of teacher behavior as criteria for evaluating their teaching performance. Neither administrators nor teachers reported any

difficulties with the evaluative procedures used.

The items in the evaluation form were arranged in rank order according to the number of teachers who were placed in the highest performance category on each item by each of the three groups of observers. Administrators, teachers, and pupils were in general agreement concerning the strengths and weaknesses of the teachers as a group.

The difference between the number of items in which a teacher was given a performance rating in the highest category and the number of items in which he was given a rating in the lowest category was used as the index of professional opinion concerning over-all teaching effectiveness. The difference between the percentage of pupils who gave a teacher ratings in the highest category and the percentage who gave him ratings in the lowest category was used as the index of pupil's opinions concerning a teacher's performance.

Administrators and pupils were in close agreement in identifying teachers who received low scores, and were in general agreement in identifying teachers who received high scores. Teachers who were rated highest by administrators and by pupils did not consistently rate themselves high, and teachers who rated themselves high were not consistently rated high either by administrators or by pupils.

No relationship was observed between the over-all performance rating of a teacher and the subjects taught.

Some relationship was observed between years of teaching experience and over-all performance rating. Teachers with only one year of experience were given the lowest ratings by all three groups. Differences were relatively slight among six other experience categories.

Microfilm \$2.00; Xerox \$4.20. 77 pages.

### A STUDY OF THE CHARACTERISTICS, FUNCTIONS, AND OPERATION OF STATE 4-H ADVISORY COMMITTEES IN SELECTED STATES

(L. C. Card No. Mic 59-3260)

George Ellsworth Hull, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Burton W. Kreitlow

This study was designed to locate current state 4-H advisory committees and to determine the characteristics, functions, and methods of committee operation. A secondary purpose was to identify characteristics, function, and methods of advisory committee operation most frequently mentioned as desirable in the literature. The two groups of characteristics, functions, and methods of advisory committee operation were then compared.

Information was obtained from 236 committee members and 122 state level 4-H staff members, representing twenty-nine committees in twenty-five states. Fourteen committees were composed of extension personnel; nine committees were composed of lay members, and six were composed of extension personnel and lay members.

# Results

1. Three-fourths of the state level 4-H staff indicated they would very definitely organize an advisory committee if not presently advised by one.

2. Committee accomplishments most frequently mentioned were: assisted with program planning; assisted with policy formulation; assisted in planning district and state 4-H events; helped two-way communication; helped develop leader training programs.

3. Barriers to effective committee functioning were: members lack sufficient information for sound decisions; members may not sufficiently understand advisory role; meetings too infrequent; failure of those advised to follow recommendations or to explain why they were not followed.

4. Thirteen of twenty statements rated as to importance and performance as advisory committee functions were the same or were related to eight functions identified in the literature. The thirteen functions are listed. The rank by importance is indicated by the first number in parenthesis and the rank by performance by the second number.

Advise on state 4-H policy. (1), (1)

Serve as means of two-way communication. (2), (6)

Make suggestions for change. (3), (3)

Evaluate current programs. (4), (15)

Consider new 4-H programs. (5), (5)

Guide state 4-H leaders in determining problems and needs of boys and girls. (6), (10)

Evaluate current activities. (7), (12)

Public relations. (9), (9)

Bring problems to the attention of the administration. (10), (7)

Problem solving purposes. (12), (8)

Determine areas for program emphasis. (13), (10)

Coordinate 4-H with other extension programs. (14),

Coordinate 4-H with other youth programs. (18), (20)

5. Characteristics and methods of advisory committee operation most consistently approved by respondents or followed in current committee practice and most often recommended in the literature were: formal committee organization; committee size; geographic representation of members; membership rotation plan; regularly scheduled meetings; committee objectives and goals; instruction and orientation for members; preparation of agenda, advisory committee reports.

6. Characteristics and method of advisory committee operation most consistently approved by respondents or followed in current practice of state 4-H advisory committees were: compensating members for expenses incurred; sending proposed agenda to members prior to meeting date; preparation of minutes; administrative

report to committee.

7. Almost one-half of the committees had state level 4-H staff members who served as regular voting committee members.

### Recommendations

1. State 4-H administrators not now advised by statewide advisory committees should consider the organization of an advisory group.

2. State level 4-H staffs serve as resource people, not

as voting committee members.

- 3. The following characteristics and methods of advisory committee operation should be considered by committees and incorporated into practice when the situation permits: formal organization; geographic representation of members; membership rotation plan; regularly scheduled meetings; committee objectives and goals; instruction and orientation of members; preparation and use of agenda; committee reports; compensating members for actual expense; preparation of minutes, and an administrative report to the committee.
- 4. State level 4-H staff members should avoid dominating committee meetings and unduly influencing committee members.

Microfilm \$4.65; Xerox \$15.60. 361 pages.

THE EFFECT OF A PRINCIPAL'S INSERVICE LEADERSHIP TRAINING COURSE UPON HIS OPERATIONAL BEHAVIOR PATTERN AND UPON ATTITUDES OF TEACHERS, PUPILS, AND PARENTS

(L. C. Card No. Mic 59-3549)

Leon Rodney Luckenbach, Ed.D. The University of Florida, 1959

This study, sponsored by the Florida-Kellogg Foundation, is one of a series of studies to investigate the leadership behavioral patterns of principals and school-community relationships.

#### Problem

During the academic year 1956 under the auspices of the University of Florida, a two-semester, inservice, leadership training course was offered to a group of 34 principals in Hillsborough County, Florida. The purpose of this study was to determine within the time interval of one year, measured at the beginning of the course and one year later, whether the principal's operational pattern of behavior changed in the democratic direction and what effect, if any, the leadership training of the principal had upon the attitudes of the teachers, students, and parents.

### Procedure

Four instruments, previously developed by the Florida-Kellogg Project, were adopted. The Principal Behavior Check List (PBCL) was given to the principal and five teachers in each experimental school. The principal was rated on a five-point scale, ranging from democratic to authoritarian. The Teacher Attitude Scale (TAS) was distributed to 20 or fewer teachers in the experimental schools. Samples of approximately 100 parents in each of the experimental and control schools were given the Parent Attitude Scale (PAS). The Student Attitude Scale (SAS) was distributed to students of the sixth grade and to samples of students, by sections, of the ninth and eleventh grade English classes in the experimental and control schools. Attitudes were measured on scales ranging from favorable to unfavorable.

Mean scores for each school were derived. Over 14,000 forms obtained from 42 schools were processed. For various reasons, some of the schools had to be eliminated. Correlation coefficients, t-ratios, and F-ratios were the statistics used to test the relationships of the data before and after the leadership course.

### Findings

1. The principal's operational patterns of behavior after the leadership course, as rated by the principals on the PBCL, changed in the democratic direction; whereas, their patterns of behavior after the course, as rated by by teachers on the PBCL, did not change.

2. In comparing patterns of behavior before and after the leadership course, the democratic principals showed less change in behavior than did the authoritarian principals, as rated by both teachers and principals on the

PBCL.

3. As determined by the TAS, teachers did not change their attitudes toward the profession, other teachers, the children, the principal, the school, and the community after the principal's leadership training.

4. As determined by the SAS for experimental and control schools, the pupils did not change their attitudes toward self, each other, the teachers, the principal, and the entire school after the leadership training of the principal.

5. As determined by the PAS for experimental and control schools, parents had less favorable attitudes toward the entire school after the leadership training of the principal. The decline in parent attitude could have been due to the increase in the criticisms of the schools following the launching of Sputnik I. The difference between the changes of parental attitudes for the experimental and control schools was not significant, however.

#### Conclusions

1. The status of the principal's operational pattern of behavior after the leadership course is uncertain.

2. The extent of change of the democratic principal's behavior before and after the leadership course in comparison to that of the authoritarian principal is uncertain.

3. The attitudes of students, teachers, and parents were not more favorable after the leadership training of the principal. Microfilm \$2.55; Xerox \$8.80. 193 pages.

### SOME CHARACTERISTICS OF PROGRAMS OF STATE SUPPORT FOR SCHOOL PLANTS

(L. C. Card No. Mic 59-3210)

Steward Donavon North, Ph.D. The University of Wisconsin, 1959

Supervisor: Dr. Russell T. Gregg

Among the factors which make it increasingly more difficult for local school units to provide school plants from local revenue alone are increasing enrollments, need for replacement of facilities, and changing economic conditions. The sizeable expenditures for school plants during the 1950's, originally thought to be only a temporary aftermath of World War II, appear to be the pattern for some time. There is little doubt that support for school plants will become prominent in state support programs. Consequently, theory of state support for school plants is a significant area of study.

### Statement of the Problem

The problem of this study was to identify characteristics of a sound program of state support for school plants, and to illustrate the practicality of such a theory by analyzing selected state support programs in terms of the characteristics.

# Procedures

To identify characteristics of state support programs for school plants and to apply the characteristics to selected support programs, these procedures were used:

(1) the findings and concepts of researchers, as recorded in literature, were studied; (2) the concepts were

reconstructed as characteristics; (3) reactions of experts to the characteristics were obtained; (4) state support programs were studied and four were selected for further analysis; (5) supplemental and interpretive data were gathered by personal conferences with state department of education personnel; and (6) conclusions were drawn.

### Results

Seven characteristics of a sound program of state support for school plants were identified. A sound program is characterized by being:

Accommodative -- It gives consideration to appropriate differences among local school units and encourages equalization of educational opportunity.

Adequate -- It utilizes state funds for all types of schoolplant expenditures, provides a sufficient amount of funds, and, in conjunction with the financial resources of the local units, meets the school plant needs of the state.

Compatible—It is accordant with the general plan of support for schools, congruous with the system of local, state, and federal taxation, consistent with the direction of educational progress, and compatible with the doctrine of state responsibility and local control.

Cooperative—It provides for a partnership between the state and local units with the various school plant responsibilities appropriately assigned and it utilizes effectively the financial and human resources of both the state and local units.

Manageable—It minimizes state—level administrative control and routine, avoids personal and political influences, and provides uniform treatment of local units regardless of the amount of state funds distributed to them.

Predictable--It facilitates estimates of state funds to be distributed, fosters long-range planning, identifies the sources of revenue for school plants, and forecasts state and local school plant needs.

Provident--It encourages economical use of funds, protects reserve funds, prescribes prudent budgeting and auditing procedures, and appraises the effectiveness of the support program.

Application of the seven characteristics to the school plant support programs of Florida, Kentucky, South Carolina and Tennessee revealed similarities and differences among these programs. When examined in terms of the characteristics, the Kentucky program of support for school plants was rated sounder than the programs of the other three states.

### Conclusions

1. There is considerable repetition in the literature of a small number of concepts relating to state support for capital outlay. Few new concepts have been added in the past three decades.

2. A functional theory of state support programs for school plants can be stated in the form of characteristics.

3. Operational definitions of the characteristics, although difficult to develop, increase the practicality of the characteristics.

4. Characteristics can be developed so that both content and administration of state support programs are included.

5. The characteristics, together with their operational definitions, provide a basis for evaluating existing programs and developing new programs of state support for school plants. Microfilm \$4.30; Xerox \$14.40. 333 pages.

WHAT PUBLIC SCHOOL BOARD MEMBERS IN THE UNITED STATES WANT TO KNOW ABOUT THEIR SCHOOLS: WITH SPECIAL REFERENCE TO ARKANSAS

(L. C. Card No. Mic 59-3043)

Avon Guy Shannon, Ed.D. University of Arkansas, 1959

Major Professor: Roy B. Allen

#### PURPOSE OF THE STUDY

The purpose of this study was to determine public school board members' felt need for information in ten major areas of board activity which are considered important by authorities in the field of educational administration. The ten major areas selected were: Finance, Board Operation, Administrative Personnel, Physical Plant, Teaching and Non-Teaching Personnel, Curriculum, Special Pupil Services, Public Relations, Objectives and Purposes, and Evaluating the School. Comparisons were made to discover significant differences, if existent, in the attitudes of board members in different groups toward relative importance of various areas of information.

### **PROCEDURE**

A checklist questionnaire was developed from the published opinions of recognized authorities with the assistance of a trial-jury of educators and a pilot survey of national school board members. Ten sample topics were selected for rating under each of the ten major headings. Checklists were mailed to 300 national board members who attended the 1959 convention of the National School Boards Association and 200 Arkansas members. Fifty randomly selected members in the following categories received checklists: each of the six national accrediting regions; in Arkansas, North Central and non-North Central, each group subdivided on the basis of experience. Responses were received from 233 of 300, or 77 2/3 per cent, in national samples and from 164 of 200, or 82 per cent, in Arkansas samples.

# FINDINGS

Critical ratio tests indicated significant differences between national experienced and inexperienced samples in only two of the ten major areas of information--Curriculum and School's Objectives. Analysis of variance tests indicated significant differences among the six regional national samples in only two areas--Finance and Non-Teaching Personnel.

Similar statistical techniques applied to the four Arkansas categories indicated that observed differences among these population groups were not significant for any of the ten major areas of information.

The total national population placed the ten major areas

of information in this order, highest to lowest: Administrative Personnel, Curriculum, Public Relations, Objectives, Board Operation, Physical Plant, Evaluation, Finance, Pupil Services, and Non-Administrative Personnel.

Arkansas board members ranked the areas as follows: Public Relations, Administrative Personnel, Curriculum, Objectives, Physical Plant, Non-Administrative Personnel, Evaluation, Finance, Board Operation, and Pupil Services. The correlation index between these two rankings of the ten major areas was .76, while the over-all correlation between the rankings of the hundred specific topics within these areas was .83.

### RECOMMENDATIONS

- 1. Public school board members should use to better advantage all available means of finding out what they want and need to know about school affairs.
- 2. National, state, and local boards should revitalize their efforts to provide board members with the desired information.
- 3. State departments of education, state teachers' associations, and state administrators' associations should cooperate more effectively in finding the desired information and presenting it clearly to board members.
- 4. State colleges and universities should emphasize the superintendent-board relationship in training administrators.
- 5. School superintendents should provide the desired information by making all reports functional, by developing written policies, and by faithful execution of board policies.
- 6. More effective means of evaluating the objectives of the school and the efficiency of the whole program, including administrative and teaching competence, should be devised and disseminated to board members.
- 7. Greater effort should be given to providing new board members with needed information in the early months of their service.
- 8. Provision should be made for more adequate means of support by exploring every possible source of increased revenue, including the federal government, and means of attaining that goal should be a vital part of the total information program.

Microfilm \$2.70; Xerox \$9.20. 205 pages.

# PROFESSIONAL AND LAY ATTITUDES TOWARD THE EDUCATION OF THE INTELLECTUALLY GIFTED HIGH SCHOOL STUDENT

(L. C. Card No. Mic 59-3066)

Gjertrud Hjorth Smith, Ed.D. University of Southern California, 1959

Chairman: Professor Lefever

It was the purpose of this study to obtain the expressed opinions of samples of several populations in American society as to what should be done with regard to the education of intellectually gifted students at the secondary school level. Questionnaires were distributed to approximately 3,500 selected individuals who represented positions of leadership in one of several populations in education or

noneducation fields; 1,459 usable questionnaires were returned. The populations included such lay groups as PTA leaders, representatives of labor, students, and community leaders, and such professional groups as principals, high school teachers, guidance personnel, education professors, and noneducation professors.

Findings. The majority of respondents preferred the establishment of segregated classes in all academic subject fields, the selection of teachers for the gifted who have particular qualifications, and the establishment of high standards of achievement with rigorous training in a hard core of required subjects for all gifted students. Judging from their own experiences, respondents considered personal guidance and encouragement from teachers, counselors, and parents to be the most influential factor in the development of intellectual resources, and poor teachers and routine subject matter to be those influences most deterrent to such development. Most respondents expressed the opinions that some form of subsidization should be provided for needy gifted students, but they were about equally divided as to whether the source should be from tax or from private funds. While most respondents favored some form of special counseling for gifted students, very few expressed the opinion that such students need the services of a psychologist more than do other students.

Certain trends of opinion were clearly established within samples: teachers tended to check responses which were more traditional and which would permit simpler classroom management, guidance directors were definitely in favor of procedures which would "free" the program for more individual pupil attention, and administrators were generally divided between the teacher point of view and that of the guidance directors. There were very few significant differences between the responses of the total professional group as compared with those of the total lay group. The largest differences in responses between any two groups were those between education professors and noneducation professors; the noneducation group responded to the more academic and traditional practices and procedures, while the education professors tended to select the more permissive and less fettered ones.

Conclusions and Recommendations. While there were deviations in point of view, it was surprising that twenty-seven groups of people involving 1,459 respondents could agree on so many items. It was clearly established that the large majority of respondents favor providing some special consideration in education for those students who are intellectually richly endowed. It is recommended, therefore, that the findings revealed in this study be considered in further research and that careful experimentation be conducted along the lines favored by these respondents to determine their feasibility and efficacy.

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Microfilm \$6.40; Xerox \$22.20. 501 pages.

RELATING THE SUBJECT-MATTER CONTENT IN ALABAMA'S TEXTBOOK READERS FOR ELEMENTARY GRADES TO CHILDREN'S READING INTERESTS

(L. C. Card No. Mic 59-3005)

Inez Runyan Smith, Ed.D. Alabama Polytechnic Institute, 1959

Supervisor: William H. Coffield

#### THE PROBLEM

The purpose of this study was to relate the subjectmatter content of Alabama's textbook readers for grades one through six in the elementary schools to the reading interests of Alabama school children. More specifically, the investigation involved an analysis of the textbook readers, questionnaires, and direct contact with teachers and children:

- 1. To discover the genuine reading interests of Alabama school children,
- 2. To classify reading interests within several categories,
- To determine the influence of the personal reading preferences of teachers upon the reading interests of the children,
- 4. To ascertain the extent to which the interests were treated in Alabama's textbook readers and
- 5. To compare and relate the reading interests of the children with the textbook readers.

### METHOD OF RESEARCH

The reading interests of 1198 elementary school children were determined through interviews and descriptive-survey instruments. The investigator, as a participant-observer, presented the reading selections which children ranked according to their preferences. The survey was carried into forty-two classrooms in twenty-two schools of Alabama. The schools were selected as being representative of the schools in the state. Consideration was given to the various school organizations and to the geographical location.

Questionnaires were used to secure the opinions of teachers concerning the reading preferences of their pupils and to ascertain the reading preferences of the teachers. Comparisons were made between the interests which the children ranked and those observed by teachers and between the choices which the children made and the personal reading preferences of their teachers.

Basal and supplementary readers for the six grades were secured, analyzed, and classified into seven categories. The relationships between the interests of the children and content of the textbook readers were determined. The Spearman Rank Order Correlation Coefficient procedure served as the analytical tool.

### CONCLUCIONS

Careful analysis of the major findings resulted in the following conclusions:

 The reading interests of Alabama school children differed widely. Differences were noted within classes, between groups, and between pupils of different grade levels. The interests of the total number of school participants ranked as follows: (1) fairy tales and fantasy, (2) hero tales, (3) animal stories, (4) non-sense, (5) realism, (6) poetry, and (7) informational.

- 2. Teachers were aware of the diversity of interests which existed among their pupils although many failed to recognize the extent and magnitude of specific interests.
- The influence of reading preferences which teachers indicated was not reflected in the choices of the children.
- 4. An analysis of the content in textbook readers ranked the categories in the following order: (1) realism, (2) animal stories, (3) fairy tales and fantasy, (4) nonsense, (5) informational, (6) poetry, and (7) herotales.
- 5. Relationships between the reading interests of children and the content of the textbook readers produced rho values as follows: (1) 4.05 per cent of the cases were above .786 (statistically significant), (2) 2.71 per cent of the cases indicated high positive relationships (.750 and .714), (3) 47.29 per cent of the relationships were medium positive, ranging downward from .679 through .429, (4) 32.43 per cent were low positive relationships, ranging downward from .393 through .018, (5) 2.71 per cent of the comparisons resulted in zero correlation, and (6) 10.81 per cent were negative relationships.

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Microfilm \$4.15; Xerox \$14.00. 321 pages.

# THE RELATIONSHIP BETWEEN PARENTAL ATTITUDE TOWARD THE SCHOOL AND DISTANCE LIVED FROM THE SCHOOL. PHASE I

(L. C. Card No. Mic 59-3563)

Lawrence Everett Smith, Ed.D. The University of Florida, 1959

This study was the first of a two-phase project in school administration concerning the influence of distance lived from school upon parental attitude toward the school. Phase I was conducted in the white schools of one county and Phase II dealt with Negro schools in the same county.

Problem.—The problem was stated by the major hypothesis. There is a decline in positive or favorable attitude toward the school as the distance which the parent lives from the school increases. This premise was divided into a series of minor hypotheses for statistical analysis. These subordinate hypotheses were:

- 1. There is no significant difference in the attitude of parents from the various school centers,
- 2. The socio-economic status of the parent does not significantly influence attitude toward the school,
- 3. The sex of the parent does not significantly influence attitude toward the school,
- 4. The length of time a parent has lived in the community does not influence attitude toward the school,
- 5. The level of the school does not significantly influence the parent's attitude toward the school,
- 6. The attitude-distance relationships is independent of the school level.

Procedures.—Attitude was measured by a total score obtained from a parent questionnaire. This instrument was used in collecting data and it proved to be highly reliable for the population studied.

Twelve elementary schools and eleven secondary schools were randomly selected for intensive study after establishing rapport in the county. In each school approximately 150 questionnaires were distributed to parents. Names were randomly drawn from class registers and each pupil chosen carried the instrument home and returned it to school when completed. A total usable return of 81.6 per cent was obtained by this method.

Data were hand coded, scored, and punched into IBM cards for final analysis. A pilot sample was drawn from the total return as a part of this operation. This was done to determine: the reliability of the instrument, the relationship between parental attitude and parental interaction or participation in school affairs, and the correlation between parental occupation and formal schooling of the parent. The reliability was .937 which was high enough for decisions regarding individuals filling out the questionnaire. A significant relationship was found between parental occupation and education. Those schools with more parental interaction rated higher on parental attitude, and parents with higher education tended to hold better jobs in the community.

The major statistical technique used was the analysis of multiple covariance. After completing test results, observations also were made in schools which differed significantly on mean attitude scores adjusted for all the influences tested by the minor hypotheses.

Results.--In general there was a significant tendency for people with higher socio-economic status to have a more favorable attitude toward the school.

Mothers held significantly warmer feelings toward the school than fathers.

Length of residence did not significantly affect attitude. Increased distance of residence significantly depressed attitude in elementary schools, but it did not have a significant effect in secondary schools.

In general elementary schools rated consistently higher than secondary schools. Elementary schools also appeared to be interacting better and communicating more with their parent populations. Those centers with better patterns of communication rated high on mean attitude score in spite of the depressing effect of some of the variables studied.

Conclusions.—The major hypothesis was accepted for elementary schools and rejected for secondary schools. However, the practical significance of the effect of distance seemed to decline in the schools which maintained effective patterns of communication with the community.

Microfilm \$7.40; Xerox \$25.40. 583 pages.

# THE PHYSICALLY HANDICAPPED TEACHER IN PUBLIC SCHOOLS

(L. C. Card No. Mic 59-3067)

William Laurence Ullom, Ed.D. University of Southern California, 1959

Chairman: Professor Nelson

The problem of this study was to determine the degree of teaching success manifested by orthopedically handicapped teachers and to ascertain whether teaching success was related to various factors, such as attendance, health, participation in community activities, problems of personal adjustment, classroom status and control, teaching load, special supervisory assignments, training and background. Credentialing practices and attitudes toward employing physically handicapped persons as teacher throughout the nation were also studied. Normative survey techniques were used in gathering informational and evaluative data.

Findings. Data of a general informational nature indicated that three fourths of physically handicapped men teachers were between 26 and 40 years of age, 70 per cent of whom had taught for less than 10 years; and that handicapped women entered the profession at an earlier age than men and had taught over a longer span of years. Physically handicapped teachers were well qualified and received very little special consideration in room assignments and supervisory duties. They achieved equally well at elemen-

tary and secondary levels.

Little distinction could be made between teaching experiences of groups of nonhandicapped men and women teachers and groups of men and handicapped women teachers. Men and women teachers without handicaps professed greater physical stamina and were less prone to accidents than were comparable groups of handicapped teachers. A consistent pattern of community participation and good representation of the schools in the community was displayed by all physically handicapped teachers. Handicapped teachers were well accepted by fellow teachers and were held in high esteem by students and parents. In general, nonhandicapped teachers were given heavier teaching assignments in terms of the number of class preparations required.

Data secured through visitations indicated that physically handicapped men and women teachers were capable of performing an above-average teaching job. Principals and handicapped teachers disagreed in rating the latters' emotional stability, principals tending to rate them as either above- or below-average in emotional adjustment and handicapped teachers rating themselves as about average

in this respect.

In the opinions of respondents from state departments of public instruction, most handicapped persons are successful as teachers, and handicapped persons are considered acceptable as teachers. They are granted credentials on the basis of ability and training in 83 per cent of states. State credentialing departments rely heavily upon colleges and universities to screen physically handicapped teacher candidates prior to application for credentials. After credentialing, local districts determine the fitness for teaching of physically handicapped candidates.

Conclusions. (1) Physically impaired teachers employed in California are demonstrating that they can meet the physical demands of the profession. (2) Handicapped

teachers are essentially no different from nonhandicapped teachers in the number of years they can be expected to continue in the profession. (3) Handicapped teachers are well accepted by students, fellow staff members, and the community.

Recommendations. It is recommended that (1) school administrators be encouraged to employ greater numbers of physically handicapped teachers, (2) colleges and universities evaluate their student counseling programs in terms of services made available for physically handicapped students, (3) positive evaluations be made of physically impaired people in terms of capabilities rather than disabilities, (4) organizations promoting the employment of physically handicapped people stress the teaching profession as a placement posssibility, (5) state departments of education evaluate their credentialing practices in terms of responsibility for accepting or rejecting applications of handicapped persons for teaching credentials, and (6) other types of physically handicapped teachers be studied to determine their effectiveness as teachers.

Microfilm \$3.20; Xerox \$11.00. 246 pages.

# EDUCATION, ADULT

# THE RELATIONSHIP OF AMERICAN COLLEGE AND UNIVERSITY MUSIC DEPARTMENTS TO COMMUNITY MUSIC ACTIVITIES

(L. C. Card No. Mic 59-3264)

Ernest Justice, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Burton W. Kreitlow

It is the purpose of this study to determine the present role of American colleges and universities in the field of adult music education (1) by determining if college and university music departments have identifiable philosophies and/or policies of action regarding community music activity, (2) by determining the relationship between existing philosophy and actual practice in the narrower field of college-community musical organizations, (3) by determining the relationship existing among various institutions concerning community music activities and (4) by determining the relationship existing between the philosophies and policies of college music departments as identified in this study, and the practices of adult music education recommended by other related studies and literature in the field.

The three significant parts of this study includes (1) a survey of 60 doctoral dissertation, accepted by American universities during the past 25 years that were related in some way to community music activities, (2) a survey of college-community music activity as reported by 90 public institutions and 115 private institutions in 46 states, the enrollments of which ranged from less than 500 to more than 15,000 and (3) case-studies of five college-community music organizations in four mid-western states. These studies of community music were made in terms of action, instruction for leadership of adult organizations and philosophy of adult music education.

It was found that the institutions of this study do have an identifiable contemporary philosophy for adult music education. A statement of philosophy was developed after identification and study of the role that 205 American college and university music departments have assumed in community music activities and shows the inconsistency that exists among the institutions as classified in this study. It was found that private institutions with fewer than 2000 students and public institutions with 3000 to 10,000 students follow a philosophy that recognizes that it is important to give assistance to community music activities by providing facilities, equipment, music and even directors for large musical organizations of community adults. If no other opportunity to participate in a symphony orchestra or oratorio chorus exists in the community, these institutions as a group have a philosophy that states it is important to include community adults in the membership of certain campus musical organizations. The philosophy of these institutions includes the important provision of classroom instruction for leadership of community music organizations. Public institutions with fewer than 2000 students and private institutions with more than 3000 students as a group have a philosophy of adult music education that does not recognize that it is important to provide assistance to community music activities. Public institutions with more than 10,000 students have a philosophy for adult music education that may or may not recognize the importance of becoming concerned with community music activities.

There are two hypotheses that have been developed from the present investigation of the relationship that exists between college and university music departments and community music activities.

- The public school is an instrinsic part of the community. Consequently a public school music teacher is a "community music teacher" but he must redefine his function to conform to the contemporary philosophy of community music activities.
- The public institutions of higher learning are community agencies and have responsibilities regarding community music activities, but their function must be redefined to conform to the contemporary philosophy of community music activities.

It is the belief of the present investigator that further investigation in the field of adult music education will produce a verification of the hypotheses just posed. The instruction for leadership of community music activities would result not in a "Public School Music Teacher" but a community conscious "Public Music Teacher."

Microfilm \$4.10; Xerox \$13.80. 320 pages.

WISCONSIN NURSING HOMES AND THE RESIDENTIAL USE OF LEISURE TIME

(L. C. Card No. Mic 59-3220)

Theodore Nelson Savides, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Burton W. Kreitlow

This study draws a picture of resident-patients as they live in the nursing home environment. Special emphasis

is placed on administrator and resident attitudes toward leisure and leisure-time activities. Wisconsin's 426 non-governmental nursing homes were stratified into five size-categories with a sixty category of governmental establishments. Five homes were randomly drawn from each of the six groups and made up the thirty institutions figuring in the study. Separate schedules, made up of open-end questions, were designed for administrators and residents, and individual or group interviews were conducted in all thirty homes.

In addition to the primary focus on use of leisure, certain peripheral subjects were examined in the course of the investigation, among them patient condition, community relationships, plant and facilities, training and educational levels of administrators and staff, residential attitudes toward old age and life in a nursing home, and standards for licensed nursing homes. Respecting the latter, it would appear that the great majority of our nursing home aged are currently enjoying physical accommodations equal or superior to those previously experienced in their own homes.

Thanks to continuing attention to the gradual improvement of the various physical aspects of nursing establishments on the part of the Division of Hospital and Related Services and the Department of Public Assistance, most homes are now comfortable, clean, and fairly convenient. The staff-patient ratio of 1:4 is satisfactory, medical attention is usually available in the home or nearby, and the daily menus appear to be nutritious and appetizingly prepared.

As regards the socio-psychological aspects of nursing home life, the situation does not appear so favorable. The popular view of nursing homes as being the place of terminal residence is confirmed by administrators and residents themselves. The aged have no plans to leave these homes, and most of them have resigned themselves to inevitable if not imminent defeat through their disabilities.

Thus, even though the various leisure activities pursued in homes throughout the state are diverse and impressive, the fact remains that few of these interest large numbers of people. For both sexes radio-listening and television viewing occupy many waking hours each week and many administrators, hard-pressed for recreational programs and facilities, have allowed, even encouraged, these media to become substitutes for more active occupations conceivably of greater therapeutic potential.

The absence of systematic and continuing programs of recreation in the great majority of Wisconsin nursing homes appears to be due to the following facts:

- 1. Resident-patients average nearly eighty years of age and the great majority suffer from at least one diagnosed illness.
- 2. The present generation of aged have little experience with leisure and have not developed skills and hobbies suitable to their present condition.
- 3. Abortive attempts on the part of administrators to interest their aged in activities have discouraged the introduction of more appropriate recreational programs and procedures.
- 4. Recreational facilities and materials are usually inadequate and staff untrained.
- 5. Private fees and charitable or government funds are inadequate to permit the development of well-planned and supervised leisure-time activity programs.
- 6. The great majority of patients prefer to lead a sedentary life, and administrators tend to acquiesce in providing it.

There is, however, a growing recognition of the therapeutic benefits to be derived from the constructive use of leisure-time. It appears likely that increasingly in the years ahead activity programs and physical therapy will be initiated in homes for the aged as valuable adjuncts to conventional medical procedures.

Microfilm \$3.75; Xerox \$12.80. 291 pages.

# EDUCATION, HISTORY

THE THEORY OF PLAY: A STUDY OF ITS
HISTORY AND PHILOSOPHY BASED ON ORIGINAL
TEXTS BY SCHILLER, FROEBEL,
COMPAYRE AND PIAGET

(L. C. Card No. Mic 59-3034)

Joanna N. Armstrong, Ed.D. University of Houston, 1959

Purpose

The purpose of this dissertation was to present an analysis of the history and philosophy underlying the play theory of childhood activities and in so doing showed the similarities which exists between European and American education.

Procedure

After a discussion of background material on the theory of play, this study presented an account of the historical and philosophical foundations of our educational system with emphasis upon its application in the primary grades.

Summary

The study analyzed the educational value of childhood play and its relation to mental growth based on original texts by Schiller, Froebel, Compayré, and Piaget. Background material for this dissertation was included in the review of literature. In the historical development outlined, the influence of philosophers and historians upon educators of the eighteenth and nineteenth centuries was

The Theory of Play was discussed through the study made of Schiller's The Aesthetic Education of Man, Froebel's The Education of Man, Compayré's Lectures on The oretical and Practical Pedagogy and Piaget's The Formation of the Symbol in the Child. Schiller's theory of play emerged as that of an idealist in education for whom play was basic to the awakening of the child's learning abilities which in time lead him to democratic action. Froebel's theory of play was translated into practice by his emphasis on self-activity and socialization through games, all directed toward giving life divine purpose in home and school. Compayre's theory of play was based on the child's desire for acceptance within the group. This desire, according to Compayré, prompts the child to imitate, then play, gradually learning to accept the moral standards and practices of society and so achieve his goal: acceptance by his group. Piaget considered play as the child's intuitive answer to comprehension. To Piaget imitation and imagination in play appeared as preparation for life, therefore essential to adjustment to the world.

In effect, habits are formed while learning through

play, and thus the ideals of society are imparted from one generation to another. Play, therefore, serves the social goals of society. To a varying degree each of the persons studied also held that the highest expression of play is to be found in the creative activities of inventors and artists.

Schiller, Froebel, Compayré, and Piaget saw the goal of learning and culture in the training of judgment and the development of moral character. Individuals so educated are enabled to simultaneously serve their own and society's best interests as such education produces well-adjusted citizens.

Conclusion

Through play and games in early childhood the individual learns to adjust to the demands of society. Such adjustment is essential to responsible citizenship and a happy, productive life. Therefore, play activities should be considered an important phase of human growth and development. In addition, a free democratic society can give expression to its highest ideals as it permits all children to play and learn side by side, creating an atmosphere conducive to tolerance and respect of one's fellow men.

Microfilm \$2.00; Xerox \$6.00. 122 pages.

THE DEVELOPMENT OF THE FINANCIAL PROCEDURES FOR THE ESTABLISHMENT AND MAINTENANCE OF CATHOLIC SCHOOLS IN THE ARCHDIOCESE OF NEW ORLEANS 1727-1958

(L. C. Card No. Mic 59-3072)

Sister M. Andree Condon, Ph.D. Louisiana State University, 1959

Supervisor: Professor Lemos L. Fulmer

It was the purpose of this study to trace the development of the financial procedures used for the establishment and maintenance of Catholic schools in the Archdiocese of New Orleans from the time of the first recorded school in 1725 until 1958.

Pertinent decrees issued in councils, synods, circulars, and pastorals were summarized. An attempt was made to determine the financial procedures practiced in the various schools as chronologically founded.

It was noted that during the colonial period the Catholic schools were financed by the Company of the Indies and then by the French and Spanish governments successively. The only Catholic school that survived this era was Ursuline Academy at New Orleans; as government funds were inadequate, this school became increasingly dependent for financial support upon the fees charged resident and day students.

During the early American period the majority of the schools opened were under the auspices of Religious Congregations. In general the Religious purchased the necessary property in the name of their Congregation and had complete responsibility for capital and operational outlay. The most common sources of income were: fees paid by resident and day students, gifts from the central funds of the Religious Congregation, and the proceeds from entertainments. With the decline in the number of boarding students, the private schools depended almost exclusively upon tuition fees paid by day students, upon receipts from

the sale of property, and upon diocesan wide appeals for funds.

The eleemoysnary institutions depended during the early part of the nineteenth century upon: public appeals for funds, state and city government appropriations, gifts from wealthy benefactors, and special benefits, particularly fairs and concerts. With the withdrawal of state aid after the Civil War they depended upon city appropriations, the proceeds of private industry, and public charity. In the twentieth century these institutions were supported principally by the Community Chest, the Department of Public Welfare, city alimony, and board. The Religious who staffed these institutions did so without financial remuneration until after the time of the organization of the Community Chest.

Prior to 1894 pastors were hesitant about contracting debts for school buildings as all church property was registered in the name of the archdiocese. With the separate incorporation of each parish by Archbishop Janssens in 1894, pastors willingly borrowed the necessary funds, and Catholic schools, legally owned, operated, and maintained by the parishes, were established in great numbers. These schools were financed by means of parish funds, obtained as tuition fees, church collection stipends, subscription pledges, and special fund raising benefits. The majority of these schools operated at a deficit. Four of them were operating tuition free in 1958, depending for income upon church collections and the proceeds from investments.

Until the latter part of the nineteenth century the typical Negro school was supported principally by the income from an adjacent white school. Following the Civil War Negro schools were founded on a wide scale. They were established and maintained principally by means of the following sources of revenue: donations from Mother Katherine Drexel, amounting to several million dollars; donations from other wealth individuals; contributions from the Negro and Indian Mission Fund and from the Catholic Board for Mission Work among the Colored People; donations from the clergy and from the archdiocese; the proceeds from private industry on the part of the students and teachers; and, special benefits. Following World War II these schools were generally supported by tuition.

Federal, state, and civil parish financial assistance was accepted where available. Catholic gave financial support to public schools in addition to financing their own schools.

Microfilm \$5.40; Xerox \$19.00. 421 pages.

PAST DEVELOPMENT AND PRESENT STATUS OF THE ALABAMA EDUCATIONAL TELEVISION NETWORK

(L. C. Card No. Mic 59-981)

Livingston Cross, Ph.D. University of Alabama, 1958

This study has traced the metamorphosis of the Alabama Educational Television Network from the initial planning stages up to the period of operation and expansion, or more exactly, from 1952 through the summer of 1957. The component parts of the account were structured as annotated below:

The problem was defined in the first chapter as being to compile a record of the past development and present status of the Alabama Educational Television Network. Procedure and sources of data were presented along with limitations of the study. The second chapter dealt with the major events occurring at the national and regional levels which were the foundation stones for the Alabama experiment with educational television. Reservation of 258 television channels for educational purposes and the story behind the formation of the Joint Council on Educational Television were among the national activities portrayed. The establishment of the Radio and Television Center at Ann Arbor, Michigan, and the building of non-commercial television stations in all sections of the country were described.

Major experiments aimed at determining the effectiveness of educational television as a teaching tool were summarized in the final portion of this chapter.

Beginning with the recounting of informal meetings in the fall of 1952, Chapter III pictured the evolution of the Persons Plan and the birth of its offspring--The Alabama Educational Television Commission.

The roles played by "pioneers" in the movement such as Mr. Graydon Ausmus, Dr. Morrison McCall, Miss Evelyn Walker, Governor Gordon Persons, and others were delineated in the narration.

Moreover, the details concerning the construction of the major part of the network facilities were noted in this chapter which concludes with the happenings in the winter of 1954 leading up to the historic telecast of January 7, 1955.

Two years of operation and expansion of educational television in the state comprised the scope of the fourth chapter. Among the highlights mentioned were the first network telecast on January 7, 1955, and the celebration on August 8, 1956 commemorating the inauguration of the network. Also included was a description of the completion of the three transmitting stations--WAIQ, Andalusia, WBIQ, Birmingham, and WTIQ, Munford, as well as studios at Birmingham, Auburn, and Tuscaloosa.

Personnel action and the development of programming procedure were depicted along with the gradual extension of services to the people of Alabama.

Lastly, the honors paid to the Commission and its employees were disclosed to show how the network gained national and international acclaim during this period.

The present status of the network and future plans formulated by the Commission were analyzed in Chapter V. Such items as the organizational pattern, the operational procedure, present offerings, and the effect of the network were discussed.

Representative programs of the three programming agencies were described in some detail in an effort to illustrate the regular offerings that are available to the people of the state by means of the transmission facilities of the network.

Lastly, definite plans for the improvement of this electronic teaching aid that have been accepted as future goals by the Commission were listed as evidences of the ongoing nature of the movement.

The final chapter, Chapter VI, summarized the main body of the study and presented some suggestions for further research. These proposals for future investigation were concerned with the evaluation of the effectiveness of teaching by television, compiling of records of the affiliates of the Commission, and coordination of the efforts of all the educational institutions of the state and the staff of the network. Microfilm \$4.70; Xerox \$15.80. 368 pages.

AN APPRAISAL OF THE ARIZONA EDUCATION ASSOCIATION AND ITS CONTRIBUTION TO THE IMPROVEMENT OF PUBLIC EDUCATION IN ARIZONA

(L. C. Card No. Mic 59-2978)

Marion Gray Donaldson, Ed.D. University of Arizona, 1959

Supervisor: Dr. R. A. Crowell

Although the Arizona Education Association was founded in 1892 and has functioned continuously since in the interests of public education and the welfare of its members, it has never attempted a comprehensive evaluation of its organization and program. It was the purpose of this study to conduct such an evaluation based on certain observable evidence and the judgments of a panel having extensive knowledge of the association.

With a membership of over ninety percent of the teachers of the state and with reasonably adequate resources, the Arizona Education Association appears to be in a position wherein it might exercise considerable influence as it seeks to achieve quality education for Arizona's children. That it has not always been successful is attributed in part to its failure to assess not only its organization and pro-

cedures but its purposes as well.

The importance of this study, then, lies primarily in the fact of evaluation. With the apparently extraordinary potential of the association, an evaluation of this nature might indicate avenues through which there could be a greater realization of that potential in behalf of improved

public education.

The study consisted of three general areas. The first was the gathering of all available information concerning the association and the organization in the most significant manner of that portion which was pertinent to the study. The second dealt with objectives which should underlie the program of the state education association while the third considered the present organization and program of the Arizona Education Association and the degree to which it has been successful in achieving an effective organization and program.

To devise a means whereby judgment might be made of the various components of the association, a series of criteria was developed. These criteria dealt with the stated purposes of the association, its structural organization, membership, financing, headquarters building and program. To evaluate the degree to which the association had achieved the objectives set forth in the criteria, a panel composed of former presidents of the association was selected to

make judgment.

On the basis of the panel's conclusions, supplemented with available facts, a list of the apparent strengths and weaknesses of the association was prepared. Among the strengths are: a democratically conceived and functioning organization, the attraction of an unusually large number of teachers to membership, a close and effective relationship with the local association, an effective cooperation with lay organizations, an adequate headquarters building, an adequate means of financing the association and a reasonably successful record of achievement of its objectives.

Its apparent weaknesses lie generally in the broad areas of purpose and the development of a program which would contribute more effectively to the professionalization of teaching and the resultant improvement of education in the

Specific weaknesses cited are related to qualitative standards for membership in the association, participation in determining standards of certification and programs of teacher education, establishment and enforcement of a code of ethical behavior for its members, provision for recruitment and in-service education programs, speaking authoritatively for the teaching profession in Arizona, contribution to the understanding of the functions of public education and the function and authority of the teacher, the definition and identification of competency in teaching, the seeking of greater autonomy for the teaching profession and the achievement of an effective public relations program.

The study then proposed a series of recommendations related to the areas of weakness. It was recommended also that a means be immediately established whereby the Arizona Education Association might begin a continuous and effective evaluation of its purposes, organization and Microfilm \$4.65; Xerox \$15.60. 362 pages.

AN EDUCATIONAL HISTORY OF THE PIMA AND PAPAGO PEOPLES FROM THE MID-SEVENTEENTH CENTURY TO THE MID-TWENTIETH CENTURY

(L. C. Card No. Mic 59-3047)

Maxine Wakefield Hagan, Ed.D. University of Arizona, 1959

Supervisor: Victor H. Kelley

A study of the history of the education of the Papago and Pima people from the mid-seventeenth century to the mid-twentieth century involves a many faceted complexity in both scope and sequence.

The two nations making the most telling educational contributions were Spain in the seventeenth century and United States in the nineteenth and twentieth centuries.

The short tenure of French intervention in Mexico had no influence on the far northern frontier of Sonora. The Mexican Government had a perceptible indirect influence on the acculturation of the Pima and Papago but made no direct contribution to formal education.

The Spanish Colonial period which lasted for over 200 years was late in influencing the arid regions of Pimería Alta. This was both a fortunate and unfortunate situation for the aborigines of this area. On the negative side this group had a shorter experience with Christianity and European culture, on the positive side Spain represented by the Council of the Indies had learned much about colonization and acculturation of native peoples before 1687 when Father Kino pioneered the area. The Council of the Indies had assigned the education of the aborigines to the various missionary orders of the Catholic Church soon after it was realized that an extensive program of education and acculturation was necessary to make them Christians and respectable subjects of the Crown and an adequate source

In Central, South America, and the more civilized areas of Mexico, education had been brought to the natives by use of well organized Mission Compounds. This system was also used in the more remote sections of the frontier, but certainly the actual Christian education on vocational training was taught by different means and under less refined circumstances. The Padres, both Jesuit and

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Franciscan, that reached Pimería Alta, were practical men who explored widely and established settlements in clusters of Indian villages. The curriculum taught on the frontier consisted of education for christianization and vocational education to increase the yield of arid land. Some construction work was also taught. First, on a primitive basis as the first missions in Visitas were established by Kino and the Jesuits who followed him and later the Franciscans taught not only the building trades but architecture, craftsmanship, and art.

The Jesuits were expelled in 1767 but little actual time was lost in the acculturation program as the Franciscans replaced them in 1768 and the mission system continued.

The one deterrent toward mission development and education on this frontier was always the foraging Apache who became increasingly dangerous after the horse was introduced as a means of transportation. The Apaches, however, were not responsible for driving mission work out of this area, but the Mexican Government which was established after the fall of the Spanish Colonial Empire. The Mexican Government declared education free, lay, and obligatory and never was able to provide schools of any nature for the northern Sonoran frontier.

The U.S. took control of part of this area after the Mexican War which closed with the Treaty of Guadalupe-Hidalgo and the rest of it was purchased in 1854 when the

Gadsden Treaty was consummated.

The new nation was unable to do much concerning the aborigines of this section of Pimería Alta for some years as the country was inadequately explored and sparcely settled. However, a U. S. policy for American Indian education had been developing since the time of the Articles of the Confederation and as soon as possible following the two treaties the Indians were subdued and placed on reservations where provisions for education were made for them by the federal government and by various missionary groups interested in the religious education and acculturation of the aborigines.

The first schools were founded on the Pima Reservation by C. H. Cook in 1872. Mr. Cook's contribution effectively lead to both religious or federal boarding schools provided for them in other parts of the nation. In 1911 the Papago section of the Pima Reservation was thoroughly explored and schools and missions were founded by Father Bonaventure O'Blasser and his colleagues. In 1917 the Papago Reservation was formally separated from the large Pima Reservation and Federal Indian Bureau schools were founded in the centers of population not previously serviced by the Catholic Fathers. The growth of educational offerings of both reservations has been consistent since the first schools were founded in the late 19th century. The pattern of education has however changed rather conspicuously from either off-reservation or on-reservation boarding schools to village day schools, either parochial or United States Indian Bureau. The most recent trend has been toward the enrollment of Indian youngsters in regular public schools established in surrounding areas for both white youngsters and Indian youngsters. The boarding schools have continued but their basic function has changed. The Phoenix Indian School and the school at Riverside, California have instituted special exhibarated programs for youngsters who were unable to receive the benefit of a day school education on the reservation and secondly have instituted vocational and sociological programs geared toward relocating Indians in off-reservation homes and jobs.

It has been the objective of the U. S. Indian Bureau to work itself out of a job by aiding the Indian to assimilate socially and economically in the dominant society. The Johnson-O'Malley Act, which provided for assistance to the Arizona State Schools financially in educating the young Indians and the special programs in the United States Indian Bureau and parochial boarding schools indicate that in the future assimilation will take place educationally, vocationally and socially.

Microfilm \$4.25; Xerox \$14.14. 331 pages.

# HISTORICAL PERSPECTIVE OF OREGON STATE COLLEGE

(L. C. Card No. Mic 59-3417)

Lillian Schroeder Van Loan, Ed.D. Oregon State College, 1959

Major Professor: James Kenneth Munford

Warmth of personal experience is combined with documented evidence in the study "Historical Perspective of Oregon State College." Certain selected individuals who have been intimately associated with Oregon State College during its period of greatest growth have permitted recorded interviews to be included. Echoing the spirit of the past, they tell the the vivid personalities who live in their memories, development of the parts of the College they knew best, adversities which were surmounted, and other personal pertinent data. Typescripts of these interviews are presented in the appendix.

The body of the study presents a perspective of the growth and development of the College as is recorded in minutes, records, laws, catalogs, reports, histories, news-

papers, and other documents.

The sequence of the study follows the natural divisions of the development of the College. The background and experience of the people of early Oregon, their aspirations for cultural advantages and the early educational ventures

attempted are briefly reviewed.

Corvallis Academy, from which Corvallis College evolved, was an early educational venture conceived by public spirited men related to no particular sectarian group. Financial difficulties forced a sheriff's sale of the Academy. The Methodist Episcopal Church South, the successful bidder, reopened the doors as the church-related Corvallis College.

The lack of adequate financing continued to be a serious handicap. Civil War sentiments divided the citizens of Oregon into opposing factions. The followers of the Methodist Episcopal Church South were frankly pro-slavery This schism may have accounted for the decline in enrollment.

In 1868 Corvallis College was designated the agricultural college for Oregon by the State Legislature. As such, the institution became the recipient of endowment as provided by the Morrill Act of 1862. Criticism arose over this situation; much of it came from within the church though an appreciable amount came from citizens who were disturbed because state funds were going to a church-related institution.

Circumstances shortly made it practical for the state to assume full control and direction of the College, making it the State Agricultural College under a board of regents.

During the subsequent forty years rapid progress was made in expanded services, building program, and in attracting well trained specialists to the campus. The College was reaching for a balanced program in extension, instruction, and research, the three-fold goal of a landgrant institution.

The progress made by the College was viewed in some quarters as competitive effort particularly among the constituents of another institution of higher education in Oregon. Economy-minded voters though aware that the State Board of Higher Curricula had cut duplication between institutions to a minimum were alert to every possibility of saving the tax dollar. A unification bill was proposed and passed, creating a State System of Higher Education and making each institution of higher education a part of the whole.

The nine presidents, from Reverend Finley, an ordained minister, to Dr. Strand, a biological scientist, have had an important part in shaping the institution. Arnold coordinated the transition from private to public institution. Gatch, an experienced university administrator, broadened the curriculum and gave the institution a new vision of service to the State. Then, for a quarter of a century, W. J. Kerr devoted himself to building an educationally effective institution. Many of these leaders kept their "eyes to the future" and in that way have prepared Oregon State College, as it approaches its centennial, to continue in its tradition of service to a great commonwealth.

Microfilm \$5.00; Xerox \$16.60. 389 pages.

A HISTORY OF THE UNIVERSITY ELEMENTARY SCHOOL, STATE UNIVERSITY OF IOWA, 1915-1958

(L. C. Card No. Mic 59-3824)

Virginia May Westerberg, Ph.D. State University of Iowa, 1959

Chairmen: Professor Herbert F. Spitzer
Associate Professor Jerry N. Kuhn

The purpose of this study was to trace the development of the University Elementary School, one of the laboratory schools of the College of Education of the State University of Iowa, from its organization in 1915 to the close of the 1957-1958 academic year. In 1915-1916 the staff consisted of a director and three faculty members, one of whom served as principal. During the 1957-1958 school year the staff consisted of a director, a principal, and seven classroom teachers, in addition to the teachers and supervisors in the areas of art, music, and physical education and the assistants to the teachers and the principal. Members of the staff of the College of Education served the school in a consultatory capacity.

Except for the director, the principal, and the supervisors in the special areas the staff of the school has, for the most part, been a nonpermanent one. This has been due to the fact that one of the functions of the school has been to provide training opportunities for a select number of students who have been identified as potential leaders in the field. During the period of their service in

the school the teachers and assistants have continued to work toward a degree and upon securing it have left the school. It has been the policy of the school to seek the services of teachers who have had highly successful teaching experiences. In the early years of the school's organization many of the classroom teachers were of undergraduate status. The trend has been toward the employment of teachers working on advanced degrees.

While the school was organized on a two-grade-perclassroom basis, the present organization includes a junior primary (kindergarten) and a separate classroom for grades one through six. Enrollment in each grade has for many years been limited to thirty children. The assessment of a tuition fee, although a relatively small one, has served to make the population of the school somewhat selective. Although the majority of the children have come from professional homes, many with a University affiliation, the farming and laboring classes have also been represented.

The basic purpose of the school has been to provide the best possible learning experiences for the children enrolled. In deciding upon which experiences should be a part of the curriculum, the administrators of the school have operated upon the premise that, except for experimental teaching practices which were a part of a study, the methods and materials used in the school would be those of proven value which could easily be adopted by the best public schools of the state. Since the founding of the school a subject-oriented curriculum with relatively stable courses of study has been followed. One of the outstanding teaching procedures used in the school has been the problem method of study.

One of the major functions of the school has been to serve as an experimental center for the College of Education and other departments of the University. The staff members and graduate students from the College of Education have been concerned primarily with the development of new methods and materials in education. Those from the other departments have also been concerned with methods and materials, but many of their studies have been directed toward the physical and emotional development of the children. While the school has always served as an experimental center, the number of studies conducted in a given year has been reduced considerably since 1940.

Another major function of the school has been to serve as an observational center for University students and for visiting educators. These observations, on a group or an individual basis, have usually been for the purpose of noting methods and materials of teaching. Each year, though, there have been observers whose major concern was the emotional and physical characteristics of the children. During the six weeks' summer term the school has primarily served as an observational center for teachers, supervisors, and administrators who have enrolled at the University for additional professional training. The curriculum for the half day summer sessions has been an extension of that followed during the academic year.

Microfilm \$5.10; Xerox \$17.00. 400 pages.

# EDUCATION, PHYSICAL

# EFFECT OF LECTURES PRESENTED IN REQUIRED PROGRAM OF PHYSICAL EDUCATION

(L. C. Card No. Mic 59-3788)

Donald Rex Casady, Ph.D. State University of Iowa, 1959

Chairman: Associate Professor Louis E. Alley

The major purpose of this study was to determine the effect of the oral presentation of important concepts of physical education upon the achievements and the attitudes of participants in a college program of required physical education.

The subjects were 555 male freshmen enrolled in the first-semester course of a college program of required physical education. The physical-education program presented to the experiment group (students enrolled in two of the five sections of classes in the required program) was the same program as that presented to the control group (the remaining three sections of students) except that six tape-recorded lectures, in which were discussed selected objectives, principles, and concepts related to physical education, were presented to the experiment group during part of their sports classes.

At the beginning of the semester each subject completed (1) a questionnaire concerning previous experience in physical education, (2) a sports-preference ballot, (3) the short form of the Wear Physical-Education Attitude Inventory, and (4) the Iowa Physical-Efficiency Test.

At the end of the semester each subject completed (1) a rating of the attitudes of selected classmates, (2) a rating of his sports-class instructor, (3) a questionnaire concerning specific aspects of the college physical-education program, (4) the Wear Physical-Education Attitude Inventory, and (5) the Iowa Physical-Efficiency Test. Also at the end of the semester the instructors of each sports class rated the attitudes of selected students.

The mean gain between the physical-efficiency scores at the beginning and the end of the semester is higher for the experiment group than for the control group (P = .02). The difference between the experiment and control groups' mean losses in attitude scores during the semester of participation is not statistically significant. The mean loss between the control groups' attitude-inventory scores at the beginning and the end of the semester is statistically significant (P = .01).

The students with low attitude-inventory scores made a greater number of favorable comments concerned with sports classes (P = .05) and a greater number of unfavorable comments about participation in conditioning exercises (P = .05) than did students with high attitude-inventory scores.

The students with highly favorable attitudes toward physical education were found to have attended high schools that offered intramural-sports programs and to have participated in those intramural-sports programs and to have liked the physical-education programs of the high schools that they had attended.

The sport of bowling was found to be preferred by more students with low attitude-inventory scores than with high attitude-inventory scores (P = .05).

The students with low attitude-inventory scores rated

their sports instructors lower than did the students with high attitude-inventory scores (P = .001).

Low, positive relationships were found between (1) the students' ratings of sports instructors and the students' attitude-inventory scores, (2) the attitude-inventory scores and the physical-efficiency scores, and (3) the sports grades and the attitude-inventory scores.

The findings in this study would appear to justify the conclusion that the presentation of lectures on physical education in a college program of required physical education is related to increased physical efficiency on the part of the participants but not to changes in attitudes.

Microfilm \$5.10; Xerox \$17.00. 400 pages.

# AN EVALUATION OF VISUAL AIDS IN THE TEACHING OF TUMBLING

(L. C. Card No. Mic 59-3792)

Francis A. Drury, Ph.D. State University of Iowa, 1959

Chairman: Associate Professor Arthur Wendler

The purpose of this study was to evaluate the effectiveness of various visual aids in the teaching of beginning tumbling to college freshmen. The evaluation was made in relation to the type of visual aid, the total number of times the visual aid was used during the instructional periods, the number of times the visual aid was used during each instructional period, and the difficulty of the stunt being taught. The visual aids used in this study were the 8-mm. slow motion picture, an average tumbler, and drawings.

Nine classes of men selected at random from the Physical Education Program of Louisiana State University were used as subjects. Three of the classes used the motion pictures as a visual aid; three used the drawings; and three classes used the tumbler. Four easy and four difficult stunts were taught to all the classes. In order to determine the effect of the number of times the visual aid was used during the various instructional periods, the number of times the visual aids were viewed was varied for each of the three classes.

After each instructional period the subjects attempted the stunt three times. They were, on each attempt, graded by a trained judge. Since there were three instructional periods for each stunt, there were nine scores for each stunt for each subject. The sum of the scores made by each subject on the easy stunts was used as the criterion score for the easy stunts, and the sum of the scores made by each subject on the difficult stunts was used as the criterion score for the difficult stunts.

Within the limits of this study the following conclusions were drawn: (1) that, disregarding levels of difficulty of the stunts being taught, no one of the three visual aids studied is more effective in the tecaching of tumbling than any other; (2) that in relation to the degree of difficulty of the stunts being taught, no one visual aid studied is more effective in the teaching of tumbling than any other visual aid; (3) that, disregarding levels of difficulty of the stunts being taught, viewing the visual aid once during the first instructional period, twice during the second period, and

three times during the third period is more effective than viewing the visual aid once during each instructional period or three times during the first, twice during the second, and once during the third instructional period; (4) that viewing the visual aid once during the first instructional period, twice during the second period, and three times during the third period is more effective in teaching easy stunts than viewing the visual aid once during each instructional period or three times during the first period, twice during the second period, and once during the third period; and (5) that the variations in the total number of times the visual aid is used for each class has no effect on the learning of tumbling skills.

Microfilm \$2.00; Xerox \$5.20. 102 pages.

# THE ROLE OF CREATIVE PLAY EQUIPMENT IN DEVELOPING MUSCULAR FITNESS

(L. C. Card No. Mic 59-3793)

Mary Margaret Estes, Ph.D. State University of Iowa, 1959

Chairman: Professor M. Gladys Scott

The purpose of this study was to investigate the effects of a program of creative activities on selected play equipment on the muscular fitness of third grade children.

The play equipment included an improvised horizontal ladder, modified parallel bars, balance beams, balance poles, doorway gym bars, a rope, and a Swedish vaulting box.

The subjects were the children in the two third grade sections at the Coralville (Iowa) School. The fitness of the children was determined by using a battery composed of eight muscular fitness tests all of which had proved valuable in previous studies. Strength, flexibility, balance, and agility were measured.

The experimental treatment for 27 subjects consisted of nineteen lessons of activities planned for use on the equipment. The lessons consisted of preliminary or warm-up activities followed by activities on the apparatus. Basic techniques were presented, and then the children were encouraged to experiment and improvise their own activities and stunts. In order to insure progression new activities were suggested and demonstrated in each lesson to challenge the development of new skills and to stimulate the improvisation by the children.

The control group of 25 subjects participated in a more or less traditional program based on games, relays, and rhythms. Activities providing maximum activity and participation were chosen. Squad organization, rotation of groups, ample supply of small equipment, and best use of class time were considered factors in making the program most effective in developing muscular fitness.

At the end of ten weeks the subjects were again tested on the eight items of the muscular fitness battery. Reliability coefficients were computed by the Pearson Product-Moment method for the bent arm hang and the stork stand. The groups were compared on the basis of the significance of the difference between means. The mean gains for each group were computed. The significance of the difference in mean gains between groups was computed to determine

the effect of the treatment on the specific ability measured by each of the tests.

The control group made improvement significant at the one per cent level of confidence on four of the eight measures of muscular fitness. Gains were shown on the four other tests, but they were not significant statistically.

The experimental group made improvement on six of the tests significant at the one per cent level of confidence. Arm strength as measured by the bent arm hang and balance as measured by the stork stand were the two additional tests on which the experimental group showed significant improvement over the control group. Gains were also recorded on the two remaining tests but they were not statistically significant.

On the basis of the findings of this study, it can be concluded that: a planned activity program over a short period of time can increase the muscular fitness of third grade children; the arm and shoulder girdle strength of the children in this third grade experimental group was increased by the use of the selected play equipment; static balance as measured by the stork stand was increased in the children who used the selected play equipment; flexibility of the girls was found to be slightly greater than that of the boys; motivation is an important factor in testing muscular fitness; the children were eager and enthusiastic in their activity on the equipment and participated freely regardless of their level of skill.

Microfilm \$2.00; Xerox \$4.60. 89 pages.

# THE RELATIONSHIP OF PERSONALITY TRAITS TO MOTOR ABILITY

(L. C. Card No. Mic 59-3809)

J. Burton Merriman, Ph.D. State University of Iowa, 1959

Chairmen: Associate Professor Louis E. Alley
Associate Professor Leonard D. Goodstein

The purpose of this study was to determine the relationship between motor ability (as measured with the Phillips JCR Test) and personality traits (as measured with the California Psychological Inventory).

The subjects were 808 high-school boys in grades 9, 10, 11, and 12. The Phillips JCR Test and the California Psychological Inventory were administered to each subject at the beginning of the 1958-59 school year. For purposes of comparison, the subjects were classified as follows: (1) upper and lower motor-ability groups, (2) athletes and nonathletes matched according to motor-ability scores, and (3) participants in team-individual sports, team sports, and individual sports.

The data were analyzed to determine (1) the significance of the differences between the means of the CPI scores for the subjects who scored in the upper 25 per cent in motor ability and the means of the CPI scores for the subjects who scored in the lower 25 per cent in motor ability; (2) the significance of the differences between the means of the CPI scores of the athletes and the nonathletes; (3) the significance of the differences between the means of the CPI scores of the participants in team sports, the participants in individual sports, and the participants in

team-individual sports; and (4) the relationship between the JCR scores and the CPI scores.

A number of statistically significant differences between mean CPI scores for the upper motor-ability group and mean CPI scores for the lower motor-ability group were found. For the ninth- to twelfth-grades combined, the upper motor-ability group scored significantly higher on ten variables than the lower motor-ability group. The lower motor-ability group scored significantly higher than the upper motor-ability group on two variables.

For the ninth- to twelfth-grades combined, six statistically significant differences were found between mean CPI scores for athletes and mean CPI scores for nonathletes matched according to motor-ability scores. The athletes scored significantly higher than the nonathletes on four variables. The nonathletes scored significant higher than the athletes on two variables. Within grades no significant differences were found between the mean CPI scores of the athletes and the mean CPI scores of the nonathletes.

Statistically significant differences between the mean CPI scores for the participants in team-individual sports and the mean CPI scores for the participants in team sports were found for four variables. On these four variables the mean scores of the participants in team-individual sports are higher than the mean scores for the participants in team sports. For one variable, the participants in individual sports scored significantly higher than the participants in team sports. No statistically significant differences were found between the mean CPI scores of participants in team-individual sports and the mean CPI scores of participants in individual sports.

For the ninth- to twelfth-grades combined, statistically significant  $\mathbf{r}$ 's ( $\mathbf{P} = .05$ ) were found between (1) the motorability scores and (2) the CPI scores for twelve variables. However, the  $\mathbf{r}$ 's are too small to be of value in predicting that subjects who score high in motor ability will score high on the personality traits or that subjects who score low in motor ability will score low on the personality traits.

In so far as personality measures may be taken to indicate levels of adjustment, persons who are high in motor ability tend to be better adjusted than persons who are low in motor ability. Microfilm \$2.00; Xerox \$6.80. 144 pages.

# AN EVALUATION OF PHYSICAL EDUCATION IN PUBLIC HIGH SCHOOLS OF LOUISIANA

(L. C. Card No. Mic 59-3497)

Guy Wilburn Nesom, Ed.D. George Peabody College for Teachers, 1959

Major Professor: Solon B. Sudduth

The purpose of this study was to survey the physical education program in senior white public high schools of Louisiana and to evaluate them in respect to standards described by the State Department of Education and the Southern Association of Colleges and Secondary Schools.

### Findings of the Study

A preliminary study of the historical background of physical education in Louisiana schools disclosed that physical education was required in Louisiana high schools as early as 1917. Louisiana became one of the first states to employ a full-time supervisor when in 1918 Mr. J. E. Lombard was named State Supervisor of Physical Training. Louisiana's first state course of study in physical education, one of the earliest in the United States, was prepared in 1917. The evolution of the program of activities and the development of certification requirements were traced from their earliest mention to the present day.

Data gathered from the one hundred schools concerning current program practices were outlined under the following topics: personnel, required classes, intramural sports, interscholastic athletics, health education, facilities and equipment, financial support, and community resources.

Fully certified by the State Department to teach and coach in physical education were 77 per cent of the 324 men and women who were teaching or coaching at least one physical education class or varisty sport in the one hundred schools. They represented 24 per cent of all teachers in the schools studied.

A majority of the schools were exceeding the minimum time-allotment of 120 minutes per week. Sixty-three required a daily program, five times per week.

Many schools offered a varied program; however, a number of the smaller schools provided instruction in from one to three sports. A total of twenty-seven different activities were observed.

The lack of written records and the absence of a program of measurement definitely limited the physical education instructional programs in many schools. Few schools had a written statement of objectives, and less than 20 per cent used written curriculum plans. Only about 25 per cent had a plan for measurement to determine the degree to which pupils were making progress toward program objectives.

Interscholastic athletics were more highly organized than physical education classes in most schools. Basketball with ninety-eight boys' teams and seventy-three girls' teams was by far the most popular sport.

Health education, no longer required by the State Department of Education, was being taught in very few schools as a separate subject. Health instruction was included in science and home economics courses in some schools as well as in a number of physical education programs.

Although some facilities were not adequate, most schools had indoor and outdoor areas necessary for at least a minimum program. There were ninety-five gymnasiums and forty-five stadiums in the one hundred schools. Only twenty-two schools possessed outdoor areas in excess of the minimum; however, most schools could take care of their programs by staggering the class periods.

Financial support from parish school boards was inadequate in a majority of cases. Seventy-one high schools
received twenty-five cents or less per pupil per year for
the purchase of physical education supplies and materials.
Thirty-seven of these schools, located in twenty-five parishes, received no financial support from the parish school
boards toward the support of their physical education programs.

Several schools were sharing facilities with communities in which they were located. Supervised playgrounds were conducted both after school and during the summer at a number of schools.

Microfilm \$3.80; Xerox \$12.80. 295 pages.

# AN EVALUATION OF THE YOGA SYSTEM OF PHYSICAL EDUCATION

(L. C. Card No. Mic 59-3309)

Ram Lakhan Prasad, Ed.D. University of Utah, 1959

Chairman: Dr. N. P. Neilson

#### I. STATEMENT OF THE PROBLEM

The general problem was to evaluate the yoga system of physical education using the Clark W. Hetherington concepts of physical education as criteria.

The specific problems involved were to:

- 1. Present a brief background of India, the birthplace of yoga.
- 2. Trace the development of the yoga system before the time of its founder Patanjali.
- 3. Describe yoga as science, philosophy and religion.
- 4. Describe the philosophical, psychological and ethical bases of yoga.
- 5. Explain hatha yoga which in part deals with a system of physical education and health.
- 6. State the criteria to be used in the evaluation.
- 7. Evaluate the yogic system of physical education.
- 8. Evaluate more specifically yoga asanas (physical exercises of yoga).

#### II. DELIMITATIONS

The principal emphasis in this study was an evaluation of hatha yoga, a branch of yoga dealing in part with the science of health and physical education and more particularly with selected yoga asanas, the yogic exercises.

#### III. METHOD OF STUDY

A clear understanding of yoga, hatha yoga, and yoga asanas was obtained by a study of literature in English, Hindi and Sanskrit. It was necessary to study in detail the science and philosophy of physical education, as presented by Clark W. Hetherington, which were used as criteria. The evaluation was made through the use of scientific analysis, seminar discussion, some experiments, and by the judgments of experts.

#### IV. SOURCES OF DATA

Sources of information consisted of various books and manuscripts dealing with physical education; books and journals on yoga and hatha yoga; and the decisions arrived at as a result of discussion with professors and seminar classes. All were of much value in the study. Besides, books on the history, philosophy and culture of India were studied for stressing the ancient heritage of the home of yoga.

#### V. SUMMARY

The yoga system of physical education is an integral part of yoga whose origin goes back to the remotest

antiquity. Basically, yoga means union and deals with the philosophy of the union of the individual soul with the supreme soul. Hatha yoga, a branch of yoga, is called an applied science because it deals with a series of bodily exercises and practical ways of making the body fit and free from diseases. Evaluation of the yoga system of physical education and more particularly of the yogasanas (yoga exercises) was made by using as criteria the four kinds of developmental values and the ten kinds of adult adjustment values contained in the Hetherington philosophy and science of physical education.

### VI. CONCLUSIONS

The following conclusions seemed to be justified:

1. The yoga system of physical education and health, the oldest system in the world, holds some good for schools, colleges and universities because it is based on sound principles of philosophy and science.

2. The evaluation made reveals that participation in yogic physical education activities under the philosophical, psychological and ethical rules of yoga results in: interpretative, impulsive, neuro-muscular and organic development; and adult adjustment.

3. Yoga physical education practiced traditionally for spiritual development may be done also for other benefits by making slight changes in teaching methods when necessary. Scientific changes in method are expected to bring results to some extent different from traditional results.

4. Selected yoga exercises have some corrective value. Some yogic exercises are useful as conditioning exercises for track and field, dance, wrestling and gymnastics.

5. Ratings by the physical education experts (three judges) indicate that the yoga asanas selected make a very good contribution to flexibility, balance and endurance but contribute only slightly to the development of strength.

#### VII. RECOMMENDATIONS

On the basis of the evaluation of the yoga system of physical education, it is recommended that:

1. Yoga exercises be introduced in the program of physical education in schools and colleges and especially in institutions which do not provide adequate facilities for games and sports, because yoga exercises are valuable and require a minimum of space and no equipment.

2. In teaching yoga physical education, the pupils be kept conscious of the high ethical, psychological and philosophical principles which form the basis of yoga.

3. Some of the asanas be selected as keep-fit exercises and that they be practiced by people of all ages in terms of individual needs.

4. Selected exercises of yoga be used in corrective physical education classes under the guidance of expert teachers.

5. Colleges of physical education include yoga physical education among the examination subjects both on the level of theory and practice.

 Institutions of higher education carry on research on the values of yoga physical education.

Microfilm \$2.65; Xerox \$9.20. 203 pages.

THE EFFECTS OF FIVE METHODS OF EXERCISE ON THE STRENGTH, ENDURANCE, AND ACTION POTENTIALS OF THE VASTUS LATERALIS, RECTUS FEMORIS, AND VASTUS MEDIALIS MUSCLES

(L. C. Card No. Mic 59-3815)

Glen P. Reeder, Ph.D. State University of Iowa, 1959

Chairman: Associate Professor Frank D. Sills

The purposes of this study were to evaluate the relative effectiveness of five methods of exercise in developing the strength and endurance of the quadriceps muscle; to determine by means of electromyography the function of the rectus femoris, the vastus lateralis, and the vastus medialis during five methods of exercise; and to compare for the five methods of exercise the action potentials developed by the three muscles at the beginning and end of the experiment.

The subjects were fifty male students in the physicaleducation skills program at the State University of Iowa. On the basis of strength measurements for the quadriceps femoris, five groups of ten subjects each were assigned to perform a specific method of exercise (Manual Resistance, Thorndike, DeLorme, Sills, and Klein) for an eight-week period.

Initial and final measurements of the strength of the quadriceps femoris, initial and final measurements of the endurance, and four records of action potentials of the three muscles were obtained for all subjects.

Each of the five groups shows for the eight-week experiment a mean gain in strength ( $\underline{P} = .01$ ). However, the differences between the mean gains are not statistically significant.

Four groups (Manual Resistance, Thorndike, DeLorme, and Sills) show for the eight-week experiment mean gains in endurance (P = .05). However the differences between the mean gains are not statistically significant.

For all five methods of exercise and for all three muscles except the vasti laterales the highest gains in mean microvoltages were recorded in the second quarter of the movement (135 to 180 degrees); for the Sills and Thorndike methods the vasti laterales show the highest gains in the first quarter of the movement (90 to 135 degrees).

The gains in mean microvoltages recorded for the three muscles for each of the methods of exercise reflects the extent to which each muscle participated in the development of the quadriceps during the experiment period. By both the Manual-Resistance method and the DeLorme method the vastus lateralis is more effectively developed than the vastus medialis and the rectus femoris. By both the Thorndike method and the Klein method the vastus medialis is more effectively developed than the vastus lateralis and the rectus femoris. By the Stills method the rectus femoris is more effectively developed than the vastus lateralis and the vastus medialis.

Based upon the highest gain in mean microvoltages for the three muscles for all five methods of exercise, the following recommendations are made: (1) to strengthen the medial aspect of the knee by developed the vasti mediales, use the Sills method; (2) to strengthen the lateral aspect of the knee by developing the vasti laterales, use the Manual-Resistance method; and (3) to strength the anterior aspect of the knee by developing the rectifemorum, use the Sills method. For all five methods of exercise the gains in mean microvoltages elicited from the three muscles during allout static contraction with 90- and 170-degree angles behind the knee joint indicate:

1. The highest gains in mean microvoltages for both the 90- and 170-degree angles behind the knee joint were, for the group that used the Thorndike method of exercise, obtained for the vasti mediales.

2. The highest gains in mean microvoltages for both the 90- and 170-degree angles behind the knee joint were, for the group that used the Manual-Resistance method of exercise, obtained for the vasti laterales.

3. The highest gains in mean microvoltages at 90 degrees behind the knee joint were, for the group that used the Sills method, obtained from the recti femorum.

4. The highest gains in mean microvoltages at 170 degree angles behind the knee joint were, for the group that used the DeLorme method, obtained from the rectifemorum.

Microfilm \$2.00; Xerox \$5.20. 105 pages.

# BODY SIZE AND FORM OF AMERICAN-DUTCH SCHOOLBOYS RESIDING IN MICHIGAN

(L. C. Card No. Mic 59-3820)

John H. Spurgeon, Ph.D. State University of Iowa, 1959

Chairmen: Associate Professor Norma D. Young Professor Howard V. Meredith

The purpose of this study was to describe the body size and form of seventy-seven seven-, seventy-three eleven-, and ninety-six fifteen-year-old North American schoolboys of Dutch ancestry; and to compare (1) the findings on size with findings on North American schoolboys of Dutch ancestry studied in 1931 and (2) the findings on size and form with findings on North American schoolboys of Northwest European ancestry studied in 1950.

#### American-Dutch Boys Studied in 1957-58

**Body Size** 

The data for stature, stem length, and lower-limb length are about normally distributed, whereas the data for thorax girth, abdomen girth, leg girth, and body weight are skewed positively. For the age of seven years the coefficients of variation in terms of percentages ranged from 15.9 for body weight to 4.1 for stature; for the age of eleven years, from 16.5 for body weight to 3.7 for stem length; and for the age of fifteen years, from 15.5 for body weight to 4.7 for stature. For the ages of seven and eleven years the differences between the percentages for the coefficients of variation ranged from 1.9 for thorax girth to 0 for stature; for the ages of eleven and fifteen years, from 1.9 for stem length to 0 for thorax girth; and for the ages of seven and fifteen years, from 1.9 for thorax girth to .3 for lower-limb length.

The increases between the means for the ages of seven and eleven years vary from 58 per cent for body weight to 15 per cent for stem length; for the ages of eleven and fifteen years, from 58 per cent for body weight to 14 per cent for abdomen girth and stem length; and for the ages of seven and fifteen years from 149 per cent for

body weight to 32 per cent for stem length and abdoment girth.

**Body Form** 

The comparisons that follow are in terms of means. The body stems of the fifteen-year-old boys are stockier ([thorax girth x 100]/ stem length) than the body stems of the seven-year-old boys. The predominance of the upper trunk over the lower trunk ([thorax girth x 100]/ abdomen girth), and the predominance of the lower limbs over the body stem ([lower-limb length x 100]/ stem length), are greater for the fifteen-year-old boys than for the seven-year-old boys. The lower limbs of the seven-year-old boys are stockier ([leg girth x 100]/ lower-limb length) than the lower limbs of the fifteen-year-old boys.

# Amercain-Dutch Schoolboys Studied in 1957-58 and 1930-31 and American Schoolboys of Northwest European Ancestry Studied in 1950

The comparisons that appear in this section are in terms of means.

**Body Size** 

The seven-, eleven-, and fifteen-year-old American-Dutch boys studied in 1957-58 are heavier than the Ameri-Dutch boys of those ages studied in 1931 (P's = .001). The eleven- and fifteen-year-old American-Dutch boys studied in 1957-58 are taller than the American-Dutch boys of those ages studied in 1931 (P's = .02 and .01, respectively).

The fifteen-year-old American-Dutch schoolboys studied in 1957-58 are taller and have longer lower limbs and greater thorax girths than the fifteen-year-old boys of Northwest European ancestry studied in 1950 (P's = .05, .002, and .001).

**Body Form** 

The seven-year-old American-Dutch boys studied in 1957-58 have stockier body stems than the American boys of Northwest European ancestry studied in 1950. The seven and fifteen-year-old American-Dutch boys studied in 1957-58 have stockier body stems and a greater predominance of upper trunk to lower trunk than the sevenand fifteen-year-old American boys of Northwest European acestry studied in 1950 (P's = .001).

Microfilm \$2.00; Xerox \$3.00. 43 pages.

A FOLLOW-UP STUDY OF NORTHWESTERN STATE COLLEGE GRADUATES IN PHYSICAL EDUCATION SINCE 1950

(L. C. Card No. Mic 59-3501)

Charles French Thomas, Ed.D. George Peabody College for Teachers, 1959

Major Professor: Solon B. Sudduth

The purpose of this study was to determine how well the training and experiences provided by the Department of Physical Education of Northwestern State College of Louisiana has prepared the individual male graduate to meet the existing job requirements relating to successful employment in the professional field. The critical incident and analytical survey methods of research were combined as the data collecting instrument.

Using critical incident type questions, the personal interview was employed to gather the data from twenty-five graduates randomly selected. Twenty-five other graduates who were also selected randomly were interviewed with specific type questions. Specific type questions were employed in addition to the critical incident questions in order to fill in the "gaps" between the extremes of behavior that are reported in response to critical instances in the graduate's experiences.

To check further on the strengths and weaknesses of the various experiences of the graduates, the employer of each graduate was interviewed. The staff members of the Department of Physical Education at Northwestern State College were then interviewed as to their professional opinions concerning the total experiences that should be provided by the Department.

### Findings of the Study

From the analysis of the most frequent items listed in the combined responses of graduates, principals, and staff members, this follow-up study indicates that the physical education program at Northwestern State College is generally adequate in preparing physical education teachers and coaches for the schools of the state and country.

The program appears to need strengthening within the following areas:

- 1. Practice teaching
- 2. Testing and measuring
- 3. Athletic training and first aid
- 4. Public relations
- 5. Proper use of grammar in speaking and writing
- 6. Football coaching
- 7. Budgeting
- 8. Purchasing and caring for equipment
- 9. Building an interest in professional organizations
- 10. On the job implementation

The areas that appear to be the strongest are:

- 1. Methods and techniques of teaching physical education classes
  - 2. Intramurals
- 3. Organization and administration of the program as a whole
  - 4. Track and field coaching
  - 5. Gymnastics

Other areas of the program seemed to be adequate.

The following recommendations are offered as a result of this study:

- 1. An evaluation of the supervision of practice teaching in physical education should be made.
- 2. Practical experiences should be provided in the football coaching courses in areas such as scouting and demonstration of fundamentals.
- 3. Consideration should be given to the provision of more coaching courses in the major sports.
- 4. Tests and measurements should be required at the undergraduate level.
  - 5. Public relations should be stressed.
- 6. Ways and means of motivating male graduates to take an active part in professional organizations should be considered.

- 7. The staff should take great pains to emphasize the need for displaying initiative and assuming responsibilities.
- 8. Opportunities to learn to repair, construct, or secure equipment suitable to the program desired should be made available to physical education majors.
- 9. More information concerning budgeting and financing should be included in the training of the majors in physical education.
- 10. Practice in filling out state and parish forms should be provided for the future teacher.
- 11. More information should be given the prospective coach concerning equipment purchases.
  - 12. Interest in the area of rhythms should be increased.
- 13. Methods and techniques of utilizing small play areas should be stressed.
- 14. Regular periodical contact between staff members of the department and graduates in the field should be considered.
- 15. Another follow-up study on the male physical education majors of Northwestern State College should be conducted in from three to five years.

Microfilm \$3.10; Xerox \$10.60. 237 pages.

# EDUCATION, PSYCHOLOGY

A STUDY OF HIGH SCHOOL STUDENTS' RECORDS AND CERTAIN TEST SCORES AS PREDICTORS OF ACADEMIC ACHIEVEMENT AT THE STATE COLLEGE OF WASHINGTON

(L. C. Card No. Mic 59-3146)

Toshio Akamine, Ed.D. State College of Washington, 1959

This study deals with the relationships between twentythree variables selected from students' high school records and college freshman pre-registration tests and the ten selected dependent variables representing the grade-point averages and the grades in certain freshman courses at the State College of Washington.

The twenty-three independent variables consist of high school grade-point average, high school rank, numbers of credits and average grades for six different subject-matter areas in high school, and the scores of the Cooperative English Tests, the WSC Mathematics Placement Test, and the American Council on Education Psychological Examination.

The records of 1,284 students from the class of 1959 were used for this study. Product-moment correlations were computed between each dependent variable and the twenty-three independent variables. Upon appraisal of single correlations, sixteen independent variables were selected for computation of intercorrelations. By combining independent variables which were selected from the correlation matrix, several multiple correlations were obtained for each dependent variable. The regression coefficients, Beta coefficients, relative contributions to the total variances, partial correlations, coefficient of multiple determination, multiple correlation coefficient, and standard error of estimate were obtained for each multiple regression.

The high school grade-point average was found to be the most useful predictor of success at the State College of Washington. The number of high school credits in specific subject-matter areas were especially poor predictors of success. The number of high school credits in "other subjects" correlated negatively with every dependent variable. The grades in specific high school subject-matter areas correlated relatively well with all dependent variables, but there were no significant relationships between high school and college grades in the same or similar subjectmatter areas except between the high school social science and the college sociology grades.

The Cooperative English Test scores were found to be useful as single predictors or in combination with some other independent variables since they correlated well with all dependent variables but correlated poorly with other

independent variables.

Generally the A.C.E. Psychological Examination correlated better with high school grades and Cooperative English tests than with college grades. Among the A.C.E. scores, the "L" and the total scores were generally more predictive of college grades than was the "Q" score. The "Q" score is not significantly better than the "L" score for predicting any dependent variable.

The WSC Mathematics Placement Test is best for predicting the college chemistry grades, but it is not as useful as other variables for predicting other dependent variables,

including the college mathematics grade.

The college grade-point average could be predicted more accurately than specific college course grades from the independent variables. The maximum correlation, .711, was obtained with the first semester college grade-point average by combining sixteen variables. This is significantly higher than the .694 obtained from combining the high school grade-point average, the Cooperative English Total, and the WSC Mathematics Placement Test. In general, the amount of increase in the size of correlation by combining two or more variables was relatively small.

The study indicates that for a more reliable prediction of academic achievement in college, some additional variables, possibly those of standardized achievement tests, may be used more effectively.

Microfilm \$2.45; Xerox \$8.60. 186 pages.

A STUDY OF RETENTION OF ARITHMETIC LEARNING WITH CHILDREN OF LOW, AVERAGE, AND HIGH INTELLIGENCE AT 127 MONTHS OF AGE

(L. C. Card No. Mic 59-3176)

John Felix Check, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Herbert J. Klausmeier

# Statement of the Problem

The purpose of this study was to test the hypothesis that retention is the same among children of low, average, and high intelligence when the original task for each child is graded to his present achievement level.

#### Procedure

Twenty boys and twenty girls of low intelligence were drawn from fourteen special classrooms for mentally

retarded educable children in either the Madison or Milwaukee, Wisconsin public schools. Twenty boys and twenty girls of high intelligence and twenty boys and twenty girls of average intelligence were drawn from fifteen regular fifth-grade classes of the Madison Public Schools. The Wechsler Intelligence Scale for Children was used to ascertain IQ. The criterion for low intelligence was an IQ of 55 to 80; for average intelligence, 90 to 110; and for high intelligence, 120 and above.

Two arithmetic learning tasks were used: subtraction and problem-solving. In the subtraction task, the child was taught ten new subtaction exercises at a level next in order of difficulty above a level at which he had subtacted proficiently. The teaching-learning time had to fall within

a ten- to twenty-minute time limit.

In the problem-solving task, the subjects were randomly divided into a retention and transfer group. Each child was given one problem in which he was required to make a given amount of money with a specified number of coins. The time to solve the problem was noted. This time could have ranged from three to fifteen minutes.

An acquisition test for the subtraction task was administered immediately after the teaching. Five minutes, seven weeks, and fourteen weeks later retention tests were administered to measure retention. In the problem-solving task, five-minute and seven-week relearning times were taken for the 60 retention students while five-minute and seven-week learning times were recorded for the 60 transfer students.

#### Results

The subtraction and problem-solving tasks were used to test the hypothesis. Using analysis of covariance to adjust for differences in first acquisition, the researcher found that there were no differences, significant at either the .01 or .05 level, among the three IQ groups, in retention for the five-minute, seven-week, and fourteen week intervals. The results from the analysis of data for the transfer group in the problem-solving task (as an applied measure of retention) produced similar results--no significant differences.

### Conclusions

The hypothesis was supported that retention is the same for children of low, average, and high intelligence at a mean chronological age of 127 months when the original task for each child is graded to his achievement level.

Microfilm \$2.75; Xerox \$9.60. 211 pages.

A COMPARATIVE STUDY OF ACHIEVING AND UNDERACHIEVING HIGH SCHOOL BOYS OF HIGH INTELLECTUAL ABILITY

(L. C. Card No. Mic 58-2748)

Edward Frankel, Ph.D. Yeshiva University, 1958

A. Problem: The purpose of this study was to investigate possible causes for the differences in scholastic performance of achieving and underachieving high school boys of presumably equivalent high intellectual ability.

B. Procedure: The experimental group consisted of fifty pairs of boys selected from the senior class of June 1957 at the Bronx High School of Science, a specialized science-mathematics centered secondary school in New York City. Each pair consisted of an achiever and an underachiever matched on the basis of equivalent intelligence quotient, score on entrance examination required by the school, and age.

Areas which were explored for possible significant differences between the two groups were: (1) aptitude (2) interests (3) health (4) personal problems (5) home and family background (6) socio-economic background (7) reaction to school subjects (8) reaction to school (9) out-of-school activities (10) vocational and college planning, and (11) academic performance in junior high school.

C. Source of Data: Instruments used for collecting the data related to these areas were: (a) Differential Aptitude Tests (b) Kuder Vocational Preference Record (c) Mooney Problem Check List (d) School records (e) Questionnaire promulgated by the investigator, and (f) Hamburger Socio-Economic Scale.

D. Summary of Findings and Conclusions: The significant differences found between the achievers and the underachievers were as follows:

1. The achievers showed greater aptitude than the underachiever in the verbal and particularly in the mathematical areas.

2. The achievers were significantly more interested in mathematical and scientific areas whereas the underachievers favored the mechanical and artistic.

3. While the chief concern of the underachiever appeared to be his present scholastic inadequacies in high school, the achiever was thinking about the future, college and vocational choices.

4. Although the underachievers were absent from school for health reasons more often than the achievers, there seemed to be no real difference in health between the two groups. Actually, the achievers registered more health complaints, specifically acne and allergies.

5. There were no differences between the groups in birth order of the subjects, size of family and home, and number of disrupted family patterns. Differences in the occupations and education of the parents existed.

(a) More of the fathers of the achievers than underachievers were in the top three occupational groups:
(1) professional (2) semi-professional, and (3) proprietors, managers, and officials.

(b) More of the fathers of the achievers had gone further in school than the mothers, whereas the mothers of the underachievers had as much formal education as their husbands.

(c) More mothers among the underachievers than the achievers were working.

6. The families of the achievers rated higher on the Hamburger socio-economic scale.

7. The achievers named mathematics as the easiest, and mathematics and science as the best liked subjects. They chose English as the most difficult and least liked. On the other hand, the underachievers chose science as the easiest and best liked subject and selected foreign language the most difficult and least liked.

8. The underachievers expressed more negative feelings towards school in terms of (a) less interest and participation in extra-curricular activities (b) poorer at-

tendance, and (c) more disciplinary offenses.

9. The underachievers were more active in organizations unrelated to school activities such as Scouts, and

social and athletic clubs. As for leisure time activities, the achievers read more, whereas the underachievers preferred shop-work.

10. The achievers were more interested in pure science and mathematics, and planned their courses accordingly in liberal arts colleges. In contrast, those underachievers planning to enter science, tended to select college programs that had direct vocational implications in applied fields of science such as engineering, architecture, and the like. A significant number of underachievers did not plan to enter science fields at all.

11. The pattern of academic performance in the junior high school revealed that at that level half the underachievers were already underachieving and their scholastic records became progressively worse in the tenth and eleventh year of high school. In contradistinction, the achievers maintained their high scholastic average. The junior high school record of scholastic attainment seemed to correlate closely with the achievement in high school.

Microfilm \$2.10; Xerox \$7.40. 160 pages.

A STUDY OF THE RELATIONSHIP OF PUPILS' SATISFACTION OR DISSATISFACTION WITH THEIR ART PRODUCTS TO IMPROVEMENT IN ART

(L. C. Card No. Mic 59-3332)

Marguerite Marie Lienard, Ph.D.

University of Washington, 1959

Chairman: Henry R. Fea, Ph.D.

Numerous studies have been reported on the effects of external reward and punishment or praise and blame upon performance and learning, but in the present study an attempt was made to compare improvement with the criterion of inner satisfaction before it was modified by external criticism. The primary purpose of the study was to determine whether or not a relationship existed between pupils' satisfaction with their own art products and their subsequent improvement in art. A secondary purpose was to consider intercomparisons of pupils' satisfaction, improvement, and achievement in art, and to compare each of these with: the time used to complete products, pupil ratings of difficulty, sociometric status, grade point, intelligence, originality, creativity, ideational fluency, and peer recognition.

From April 15 to June 2, 1958, each of 163 pupils in the writer's classes in an urban junior high school produced seven art samples which were subsequently rated for achievement and for evidences of creativity by a jury of three art experts. Comparisons of early achievement with later achievement determined the improvement scores used in the study. Satisfaction ratings were obtained directly from the pupils who used a ten-step satisfactiondissatisfaction scale which had been cooperatively devised by the participants and teacher. The California Reading Test, Intermediate form, and the Thurstones' Primary Mental Abilities Test, Intermediate form, provided the intelligence quotients used, and the test, Consequences, the originality and fluency scores used. Pupils based their difficulty ratings on a ten-step scale. Sociometric status and peer recognition were determined by pupil choice processes in the classroom.

The giving of peer recognition before the products were finished and rated for satisfaction was controlled first by obtaining the willingness of pupils to refrain from giving signs of approval or disapproval to others until all work was finished. Recognition was further controlled by close observation and checking of individuals at ten minute intervals for deviations from intent work. To determine whether or not original satisfaction ratings had been influenced by recognition undetected by the teachers, pupils were asked to give second satisfaction ratings after their work had been evaluated by peers. Comparisons of first and second satisfaction ratings showed consistent changes. Low achievers dropped their satisfaction ratings after peer evaluation, while high achievers raised theirs. Before peer recognition was given, the satisfaction ratings of high and low achievers in art were not significantly different; but afterwards the difference was highly significant. Thus, it was concluded that recognition had been a negligible factor in original satisfaction ratings.

The findings answered three questions concerning (1) the relationship of satisfaction and improvement in art, (2) the level of satisfaction associated with improvement, and (3) the possible relationships of satisfaction ratings, improvement scores, and achievement scores with one another and with nine other criteria.

No significant correlation was found between satisfaction and improvement; only extreme dissatisfaction was associated with improvement. No statistically significant correlation of satisfaction ratings with any one of the criteria used in the study was consistently found, although in three out of seven cases satisfaction and art achievement were reliably related. A positive correlation, significant at the .01 level, was found between improvement scores and the time used to finish products. Art achievement scores correlated significantly with grade point, reading and reasoning intelligence quotients, originality measures, and creativity scores.

Microfilm \$2.00; Xerox \$5.00. 100 pages.

RELATIONSHIPS AMONG SELF, PARENTAL, AND TEACHER BEHAVIOR DESCRIPTIONS OF SUPERIOR SECONDARY SCHOOL STUDENTS

(L. C. Card No. Mic 59-3209)

William Joseph Mueller, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor John W. M. Rothney

The purpose of the study was to examine the relationships among the statements of a group of superior secondary school students, their parents, and their teachers about the behavior of the students in eight areas which were labeled for brevity as nervousness, sociolmindedness, openmindedness, influence, acceptance by peers, academic performance, responsibility, and acceptance of peers.

Each of the students described himself, his ideal, and his concept of the superior student and predicted how his father, mother, and most of his teachers would describe him in the same areas. The parents and teachers described the students, predicted how they would describe themselves, and described the "generalized" superior student.

A forced choice card sorting device, consisting of three cards in each of the eight areas mentioned above, was used by the subjects in making their descriptions and predictions. The three cards in each of the eight areas were designed to sample discrete behaviors which could be ordered according to their enhancing character.

Profile analyses were computed to determine relationships between the individuals and groups. Each of the variables was also analyzed to determine the areas of profile similarity. Finally, the data were treated descriptively by determining the deviation of each child's score from his mother's, father's, and modal teacher's score on each variable.

Analysis of the data indicated that of all the groups, including the students themselves, only the fathers described their own children in the same overall way that they described the "generalized" superior student. The students' self descriptions also differed from their ideal, the students used the more enhancing responses almost exclusively. There were no overall differences, however, between the way that the students said they wanted to be and the way they described the superior student.

The students predicted that the groups of adults would respond to them in different ways. When the students' predictions for the adult groups were compared with their own self descriptions, they differed in overall response from all the groups and in profile from the parents. Inspection of the mean differences indicated that they thought their parents would describe them in a less enhancing way and that their teachers would describe them in a more enhancing way than they themselves did.

In comparing the students' predictions with the actual responses of the adults, the students were found generally to predict accurately about the teachers' responses but inaccurately about their parents' responses. In reality, the parents had described the children in a more enhancing way than the children themselves did.

The parents' descriptions and predictions of their children's self descriptions were compared. The mothers, but not the fathers, described their children as they thought the children themselves would. The fathers described the children in more enhancing terms than they predicted the children would. Both parents were good predictors of the students' self responses and the teachers were generally inaccurate. The teachers predicted a less enhancing response than the students actually used in their self descriptions.

This study indicated a need for the counselor to increase the teachers' information about how the child would describe himself. The teachers apparently did not think that the child considered himself as enhanced a person as he actually reported. It was also suggested that the disparity between the groups' descriptions of the students and their concept of a superior student may be bridged by attempting to develop in the students the enhancing qualities that the subjects attributed to the superior student or by making available to the groups results of recent research on superior students.

Microfilm \$3.25; Xerox \$11.00. 250 pages.

#### THE MENTALLY RETARDED AS CITIZENS

(L. C. Card No. Mic 59-3813)

LeRoy Peterson, Ph.D. State University of Iowa, 1959

Chairman: Assistant Professor Lloyd L. Smith

The purpose of this study was to investigate and compare the post-school adjustment of a selected group of educable mentally retarded adults with that of a selected group of normal adults of like chronological age and sex. The adjustment factors investigated were educational, work, home, family, social, and civic characteristics.

There were forty-five adults in each of the retarded and comparison groups. Fifteen in each group were females; thirty in each group were males. The median age of the retarded females was twenty-four years, four months; that of the comparison group, twenty-four years, five months. The median age of the retarded males was twenty-three years, eleven months; that of the comparison group, twenty-four years. The mean intelligence quotient of the retarded subjects was approximately 65; that of the comparison group approximately 103.

The investigation used the technique of matched groups with data gathered by personal interviews. The results of the study were analyzed by means of comparing the responses of the subjects of the retarded group with the responses of the subjects of the comparison group for each of the 117 items included in the interview questionnaire.

The results indicated some striking deficiencies of the retarded as citizens. Some of the major deficiencies were:

- The retarded spent less time in school than did the members of the comparison group.
- 2. Many retarded subjects did not find jobs immediately upon leaving school.
- 3. Only slightly over half of the retarded subjects were currently employed.
- 4. The retarded changed jobs frequently.
- 5. The retarded were not familiar with rehabilitation, employment, and counseling agencies.
- 6. Most retarded subjects lived in substandard homes which were located in below-average areas.
- 7. The retarded did not utilize recreational facilities of the community.
- 8. Many of the retarded subjects had numerous encounters with the law over the years. Many serious offenses were committed.
- 9. Only a few of the retarded males had served in the armed forces; many had been declared IV-F.
- 10. Many of the retarded subjects had abused their financial credit.

In view of the deficiencies noted, and the possibilities for ameleoriating them through continued schooling, it is contended that a well-organized two or three year program is needed on the senior high school level to prepare the educable mentally retarded more adequately for community membership.

The curriculum of the proposed senior high special

class should include the following elements, indicated as needed by the results of this investigation:

- 1. experiences in the development of attitudes and concepts which are required in community membership.
- 2. an intensive study of jobs, job requirements, and job opportunities in the community.
- provision for gaining knowledge and familarity of the various community agencies that can help the students with their vocational social, and personal problems.
- 4. a course in driver training.
- 5. provision for school-work experience.
- 6. intensive instruction in home and family living.
- availability of school counseling services.
   Microfilm \$2.35; Xerox \$8.20. 180 pages.

### A STUDY OF PREDICTED AND MEASURED ACHIEVEMENT AND SOME POSSIBLE CAUSATIVE FACTORS OF DIFFERENCES

(L. C. Card No. Mic 59-2970)

Charles Henry Richmond, Ed.D. The University of Oklahoma, 1959

Major Professor: Henry D. Rinsland

The primary concern of this investigation was to measure the achievement of secondary school students, to compare it with their potential achievement as measured by intelligence tests, to locate students whose measured achievement is above or below their predicted achievement, to determine the correlations of predicted achievement and actual achievement, and to compare characteristics of students achieving below to those achieving above their level of intellectual expectancy.

The eighth grade of the Oklahoma City Public Schools with an enrollment of 3,806 students in thirteen partially integrated secondary schools was studied. Two measures of potential achievement were used: intelligence as shown in I.Q. and anticipated achievement computed by a formula of the California Test Bureau, using intelligence, chronological age, and school-grade placement. Two measures of actual achievement were used: grade-point average and a standardized achievement test battery.

The difference between each student's measured achievement and his anticipated achievement in tenths of a school year was computed. Over-achievers were defined as students with a difference of one and one-half standard deviations, or more, above the mean difference, and under-achievers students with the same deviation, or more, below the mean difference; one and one-half standard deviations is one and two-tenths school years. These students completed a questionnaire and were then rated by a classroom teacher on characteristics by a five-point rating scale.

The individual schools with the highest mean intelligence more nearly approach their anticipated achievement, while the schools with lowest mean intelligence fall the furthest below their anticipated achievement. I.Q. and anticipated achievement are about equal in predicting grade point average but more accurate in predicting standardized test results. A multiple regression equation using intelligence and measured achievement is given to predict gradepoint averages.

The over-achievers have a higher standardized-test achievement and grade-point average, are younger in age, and have fewer absences than the average- and under-achievers. Over-achievers are predominantly female; under-achievers predominantly male. The high and average intellectual students are both profiting from their education, but the lower intellectual group is falling significantly behind.

On the following characteristics teachers rated the over-achievers highest, the average-achievers next, and the under-achievers lowest: industry, initiative, cooperation, responsibility, self confidence, emotional stability, and seriousness of purpose.

The questionnaire indicates by a significant difference the following to be true for the over-achievers: more students never fail to be promoted, expect to go farther in school, hold more offices in school organizations, have attended fewer different schools, attend Sunday school and church more often, come from smaller families, have fewer older siblings, and more of their parents are members of P.T.A., attend more school functions, and have more formal education.

Microfilm \$2.00; Xerox \$6.00. 124 pages.

# READING, LISTENING, AND READING-LISTENING COMPREHENSION BY SIXTH GRADE CHILDREN

(L. C. Card No. Mic 59-3131)

Jack Ernest Smith, Ph.D. Columbia University, 1959

This study compared comprehension of factual paragraphs by reading, listening and reading-listening methods. In the latter method subjects silently read the text and simultaneously listened to the same material.

It was hypothesized that comprehension would vary as a function of method of presentation, with the simultaneous mode superior to either reading or listening alone. This hypothesis was justified in terms of elimination of error, multi-sensory stimulation, and practice effects. Subsidiary hypotheses stated that the simultaneous mode would be relatively more effective for bright children and for children with remedial reading experience, and that the method would be preferred by the two groups for purposes of "enjoyment" and "learning."

The subjects were 180 6th grade pupils with a mean California Test of Mental Maturity IQ of 101.8 (SD 12.1) and mean Iowa Every-Pupil Tests of Basic Skills Vocabulary and Comprehension percentiles of 50.7 (SD 25.4) and 43.4 (SD 27.4), respectively. Six subgroups were selected on the basis of differing mental and reading abilities. These subgroups were designated high IQ-high reading achievement, average IQ-high reading, average IQ-average reading, average IQ-low reading, low IQ-low reading, and remedial reading. The latter subgroup had had six months or more of remedial reading and were rated favorably by teachers.

The comprehension test was nine passage-question units from the McCall-Crabbs Standard Test Lessons in Reading.\* Immediate recall was tested. Questionnaires and interviews were given to determine pupil preferences for the methods.

The major hypothesis was tested by rotating nine method, nine passage, nine class and nine order variables in the Graeco-Latin Square. Analysis of variance indicated methods as the only significant source of variation; "t" ratios were computed for differences among methods. Correlations among method, reading and IQ variables were obtained. The significance of method differences for subgroups, and percentages of pupil preferences for methods, were determined.

One examiner gave all oral presentations at a controlled rate of about 110 words per minute. Questions, like passages, were read, listened to, or both listened to and read.

Results indicated that for the total population readinglistening resulted in greater comprehension that listening (.01 level) but was not statistically superior to reading. The major hypothesis was partially confirmed.

The high IQ-high reading subgroup had significantly higher comprehension by reading-listening than by listening (.01 level) as did the remedial subgroup (.05 level). The simultaneous method was superior to reading for the remedial (.01 level), but not for the high-high, subgroup.

Fifty-five per cent of the remedial subgroup found reading-listening most enjoyable; 90 per cent believed it most effective for learning. The high-high subgroup strongly preferred reading to either of the other methods. Subsidiary hypotheses were partially sustained.

Reasons given by subjects for preference of readinglistening involved practice effects, the presumably minimal effort required, cooperation with an adult, and elimination of errors. Objections to the simultaneous method included the slower rate compared to reading, and distraction by oral-aural stimulation.

Results were discussed in terms of educational application and a reformulation of the problem.

Microfilm \$2.00; Xerox \$5.20. 104 pages.

\*McCall-Crabbs Standard Test Lessons in Reading, Bureau of Publications, Teachers College, Columbia University, 1950.

### EDUCATION, TEACHER TRAINING

SCIENCE UNDERSTANDINGS CONSIDERED IMPORTANT FOR CHILDREN AND THE SCIENCE REQUIRED OF ELEMENTARY SCHOOL TEACHERS

(L. C. Card No. Mic 59-3491)

Paul Payne Bryant, Ed.D. George Peabody College for Teachers, 1959

Major Professor: Maycie K. Southall

#### The Problem

This study was made to determine the amount of attention the required science courses in selected colleges for teacher education give to the science understandings considered important for children.

#### The Procedure

Twenty curriculum guides recommended by a committee of the Association for Supervision and Curriculum Development were analyzed to ascertain the science understandings recommended for grades one through six. The understandings found were classified by grades, fields of science, and environmental areas.

In order to obtain some agreement as to science understandings important to children only those understandings suggested by one-fifth or more of the guides were used. Since many of the understandings were related, persons of recognized ability in the different fields of science were asked to synthesize them. The resulting ninety-eight science understandings were assumed to be important to children and to the science education of elementary school teachers.

The science programs of institutions holding membership in the American Association of Colleges for Teacher Education were also studied. An administrative officer of each member institution was requested to give titles of science courses required of elementary majors and the names of the instructors. Each instructor was then sent a questionnaire-rating scale containing the science understandings considered important to children and was asked to indicate the amount of attention each understanding received in their required course, using the ratings "none," "little," "some," and "much." Other pertinent information was also requested. The amount of attention each science understanding received was determined by arbitrarily assigning numbers to each rating and using a formula to obtain its relative value.

# Findings and Conclusions

Elementary science curriculum guides show little uniformity in either their form or content. A mean of 396 different science understandings suggested for each grade indicated little agreement among curriculum workers as to the elementary science curriculum. They seem to agree, however, that learnings should be from both the biological and physical sciences, with more emphasis on the latter at the upper-elementary level. While there was no agreement on specific grade placement of understandings, there was some agreement as to their importance for primary and for upper grade children. It was interesting to find that many science understandings were recommended at all grade levels.

The 225 institutions studied require a mean of 17.7 quarter hours of science for elementary majors. Although some permit student-advisee selection of courses, most institutions specify the science requirements. Biological and physical science survey courses and elementary science methods are the type of courses most frequently specified. Course content is usually determined by the instructor and based on students' needs, but the instructional activities reported generally centered around the instructor.

While some important science understandings probably receive enough attention to be familiar to teachers, the overall attention given ranges between a point slightly below "little" and a point slightly below "some." Furthermore, certain understandings from physics, health and hygiene receive no attention in one-half or more of the required courses. However, some understandings may receive attention in courses other than science.

Although the instructors of required science courses are as well prepared as college teachers in general, over three-fifths have had no experience in teaching children. Since they are usually affiliated with the science department, they may have little in-service opportunity to know the science needs of elementary school teachers.

To summarize, the findings emphasize the need for institutions to study their required science program for prospective teachers of children. And, it is hoped that the present study may prove helpful to institutions revising their science program.

Microfilm \$3.75; Xerox \$12.60. 289 pages.

# THE ROLE OF COLLEGES AND UNIVERSITIES IN CIVIL DEFENSE

(L. C. Card No. Mic 59-3304)

Carl Herbert Jacob, Ph.D. University of Utah, 1959

Chairman: Dr. Paul C. Fawley

### I. THE PROBLEM

It was the purpose of this study to inquire into (1) what colleges and universities were doing in civil defense and (2) what administrators and eduators thought they should be doing. The term "civil defense" was taken in the broad sense to include all non-military activities undertaken by the government or by individuals in the interest of survival in the event of modern warfare or any other major catastrophe.

#### II. PROCEDURE

A questionnaire, patterned after a set of questions suggested by the "Committee on Civil Defense and Higher Education," was sent to 1,053 college and university administrators throughout the United States. Follow-up letters and personal interviews were also employed.

### III. FINDINGS

Of the responding schools, 32 per cent reported activities to train students and staff for personal survival; 18 per cent reported preparations to protect the physical plant from disaster; 24 per cent said they were educating and training students for leadership in civil defense; 10 per cent reported specific research in civil defense; 45 per cent stated they were participating in community Civil Defense activities; and 27 per cent were maintaining a campus civil defense organization.

Only 8 per cent of the administrators indicated that they considered civil defense activity on the campus to be impractical or hopeless. More than nine out of ten expressed a willingness to cooperate wholeheartedly with Civil Defense officials at all levels. Many of them lamented the apathy of the general public and the ineffectiveness of present Civil Defense planning and action.

#### IV. CONCLUSIONS

1. Most college and university administrators recognize the seriousness of the threat of a thermonuclear attack upon the United States.

- 2. There have been serious failures on the part of Civil Defense organizations at all levels, and most of these can be traced to lack of proper emphasis on civil defense by the Federal Government.
- 3. In the world-wide crisis colleges and universities have a responsibility for the safety of their own students and staff and the security of their own physical plants. In addition they have a responsibility to cooperate with the existing Civil Defense organizations, to educate and train students for leadership in civil defense, and to lead out in awakening the public and the government to the need of a more realistic civil defense program.

#### V. RECOMMENDATIONS

- 1. The Federal Government should cease its half-way emphasis on civil defense and should place an all-out civil defense program on the same level as military defense.
- 2. The Office of Civil and Defense Mobilization should expand its contacts with and offer more leadership and guidance to the colleges and universities.
- 3. With the assistance of the colleges and universities, the OCDM should devote more attention to the long-range problems of survival.
- 4. As leaders in public thought, colleges and universities should assist in breaking the public apathy toward civil defense.
- 5. Every college and university should offer its services and facilities to the Civil Defense organizations of its communities.
- 6. Every college and university should take the precautions and make the provisions necessary to maintain the security of its physical plant and the safety of its students, staff, and faculty.
- 7. Every teacher should take advantage of the opportunities to introduce civil defense materials into his regular courses
- 8. Where practical entire new courses in civil defense should be introduced into curricula.
- 9. Every college and university should have a civil defense organization to encourage and carry out these recommendations and others that may be necessary for a realistic campus civil defense program.

Microfilm \$4.25; Xerox \$14.20. 330 pages.

# A STUDY OF ACHIEVEMENT IN SECOND-YEAR TYPEWRITING

(L. C. Card No. Mic 59-3362)

Carl McCoy, Ed.D. The University of Oklahoma, 1959

Major Professor: Gerald A. Porter

This study constitutes an attempt to discover the extent of learning of students during the course of instruction in second-year typewriting in certain public high schools in Oklahoma.

In completing the investigation an attempt was made to determine the extent of students' achievement during the second year of typewriting in terms of: (1) changes in ability to typewrite straight-copy material; (2) changes in number and kinds of typewriting errors; and (3) changes in the ability to perform typewriting production work.

The data in this study are limited primarily to that obtained through three administrations of "The Students Typewriting Tests," Volume XIII, Test 3, to 221 students enrolled in 15 classes of second-year typewriting, taught by ten different teachers, in four secondary schools in Oklahoma City. Personal data were gathered by means of questionnaires filled out by the participants, and from the permanent records in the administrative offices of the participating schools. The test was first administered during the second week of classes in September, 1956; again during the eighteenth week of instruction, in January, 1957; and a third time during the thirty-fifth week of instruction, in May, 1957.

Summary statements of the principal findings and conclusions resulting from the statistical treatment of the data are presented in the following section:

- 1. The participants were approximately twice as proficient in the elements tested at the end of the second year of instruction as they were at the beginning of that year.
- 2. The number of both timed-writing, and productiontest errors declined during each semester.
- 3. Typewriting proficiency had no significant effect on the kinds of timed-writing errors committed.
- 4. Approximately two-thirds of all errors committed on each part of the test were committed by students who ranked in the lower half of their class.
- 5. Students' proficiency in both straight-copy and production typewriting was approximately twice as great at the end of the fourth semester as at the beginning of the third semester of typewriting instruction. However, the straight-copy typewriting proficiency of approximately 80 per cent of the students is still below the speed and accuracy standards for beginning employment. Productiontypewriting standards are quite nebulous. However, at the end of the second year of instruction in typewriting, it appears that most students do not possess production-typewriting proficiency equivalent to employment standards for beginning typists.
- 6. Certain individuals should continue to be afforded the opportunity, provided by instruction in second year typewriting, to gain the typewriting proficiency required for employment as typists. Microfilm \$3.10; Xerox \$10.60. 238 pages.

# CRITERIA FOR A PROGRAM OF IN-SERVICE EDUCATION IN THE ELEMENTARY AND SECONDARY SCHOOL

(L. C. Card No. Mic 59-3084)

Elbert Lee Self, Ph.D. Louisiana State University, 1959

Supervisor: Professor Ralph L. W. Schmidt

The purpose of this study was: (1) to validate a set of criteria which was concerned with the in-service education of teachers, and (2) to apply these validated criteria to selected schools in Louisiana.

In the selection of the national jury to be used in the validation of the proposed criteria nominations were sought from key persons in the field of education in each state in

the union and the District of Columbia. One hundred specialists were selected and sent questionnaires containing the one hundred eighty-seven proposed criteria. The jury was to consider each criterion to be: (1) very important, (2) important, (3) of average importance, (4) of little importance, or (5) not important. Fifty-one of the jurors returned properly completed questionnaires and these were used in this study.

One hundred seventy-two of the proposed criteria were considered to be valid as was determined by the number of responses of the jurors. A criterion was considered to be sufficiently valid when seventy-five per cent or more of the jurors indicated it to be of average or better in importance.

The validated criteria were assembled into a questionnaire and sent to selected school principals in Louisiana. They were requested to determine if these criteria were: (1) excellently observed, (2) well observed, (3) moderately observed, (4) poorly observed, or (5) not observed in their in-service programs. Thirty-eight of the forty-three Louisiana school principals returned their questionnaires properly completed, and these questionnaires were used in this study.

The five areas of in-service education as were used in this study are: (1) purpose and philosophy, (2) planning, (3) administration, (4) procedures, and (5) evaluation. In determining the degree to which these criteria applied to the in-service programs of the schools used in this study, the data were presented in the following manner: (1) The rank order of the criteria in each area, as determined by the responses of the Louisiana educators was compared with the rank order of the same criteria by the national jury. (2) The rank placement of certain criteria by the Louisiana educators was compared with the rank placement of the same criteria by the national jury. (3) The rating categories receiving the greatest number of responses by the Louisiana educators were explained and shown in tables. (4) The criteria considered to be observed adequately and inadequately were pointed out.

The following conclusions were made as a result of the

findings of this study:

1. The criteria validated in this study provided an appropriate frame of reference for the evaluation of a program of in-service education for professional personnel in elementary and secondary schools.

- 2. Since the jury validating the criteria was selected from all sections of the United States these criteria are applicable to programs of in-service education in schools of other states.
- 3. According to the degree to which the criteria in each area were observed by the Louisiana educators in the schools applying them, it is apparent that various phases of the in-service programs in these schools need re-evaluation. Some of the criteria in each area were observed by the Louisiana educators to a lesser degree than the relative degree of importance accorded them by the jurors. Several criteria in Area Three, Administration, were observed inadequately by the principals in the schools applying these criteria.
- 4. In light of the methods and techniques of the study it is evident that similar studies could be made of in-service education for the non-professional personnel of the elementary and secondary schools in Louisiana.

Microfilm \$3.60; Xerox \$12.20. 277 pages.

AN APPRAISAL OF THE UNDERGRADUATE PROFESSIONAL PROGRAM IN TEACHER EDUCATION AT WESTMINSTER COLLEGE, SALT LAKE CITY, UTAH

(L. C. Card No. Mic 59-3308)

John Stanley Telecky, Ed.D. University of Utah, 1959

Chairman: Dr. F. Robert Paulsen

Problem. The purpose of this study was to appraise the undergraduate professional program in teacher education at Westminster College, Salt Lake City, Utah, in order to make recommendations for its improvement. The appraisal of the program was made on two bases: (1) a review of the present program to note if, and to what degree, it was providing opportunities for prospective teachers to develop necessary and/or desirable teacher competences; and (2) a comparison of the program with the professional education programs of other institutions to determine if certain changes might be advantageous.

Sources of data and methods employed. The first objective of the study was to adopt as a framework six general areas of teacher responsibility, or the various roles played by the teacher. To implement this framework, a search was made among the literature for specific competences needed by teachers to effectively carry out these responsibilities, or fulfill the roles. Judgments as to the final statements were made in the light of current thinking, practices, and trends in teacher education, as revealed in the literature, and in the light of the philosophy and objectives of Westminster College. A final product was distilled in the form of ninety-six teacher competences, which comprised the criteria for appraisal of the program. An instrument of appraisal containing the criteria and a list of twenty-four questions pertaining to the professional education program was submitted to the forty-one teachergraduates of Westminster College during the past three years, who were currently teaching in the public schools. Each was asked to indicate to what extent, in his judgment, the Westminster professional education program in general, and the specific required courses in particular, provided opportunities to students to develop each teacher competence.

A second major objective of the study was a comparison of the professional education program at Westminster College with the programs of twenty-one institutions reputed to be outstanding in teacher education.

Findings. Application of the criteria and judgments of the teacher-graduates indicated: some duplication and overlapping of subject matter among the professional education courses; inadequate opportunity to develop competences in measurement and evaluation, informal procedures, record-keeping, reporting to parents; and lack of emphasis in the program upon teacher-parent and teacher-community relations. The teacher-graduates indicated a need for: more laboratory experiences prior to student teaching; a longer student teaching period, in more than one subject and/or at more than one grade level; and more cooperative planning by college supervisors and cooperating teachers.

The strengths and areas of desired improvement which the twenty-one selected institutions indicated in their programs suggested a trend towards: many and varied opportunities for professional laboratory experiences prior and subsequent to the student teaching period; good admission and screening practices; good programs of guidance and counseling of prospective teachers; an institution-wide interest in and approach to teacher education; and continuous attempts at program evaluation and improvement.

Conclusions. Application of the criteria and comparison of the Westminster program with the programs of the twenty-one selected institutions indicated a need at Westminster College for: provision of more and varied opportunities for professional laboratory experiences, including student teaching; more inter-communication among members of the Education faculty; greater flexibility in the professional education program; machinery for counseling and guidance; machinery for recruiting and selecting prospective teachers; and a coordinating faculty council.

Microfilm \$4.20; Xerox \$14.20. 327 pages.

### EDUCATION, THEORY AND PRACTICE

AN ANALYSIS OF CRITICAL THINKING IN A COLLEGE GENERAL ZOOLOGY CLASS

(L. C. Card No. Mic 59-3355)

Juet Carl Bass, Ed.D. The University of Oklahoma, 1959

Major Professor: Gail Shannon

The purpose of this experiment was to discover the relationship between total raw-scores on departmental examinations administered to students in Zoology I at the University of Oklahoma and two standardized tests of critical thinking, the Watson-Glaser Critical Thinking Appraisal, Form AM, and Test of Critical Thinking, Form G, prepared for the American Council on Education. Total raw-scores of the subjects on The Ohio State University Psychological Examination, Form 23, The Iowa High School Content Test, Form L, and The University of Oklahoma Mathematics Placement Examination, Form 3, were also utilized.

Subjects were ninety-three seventeen- and eighteenyear-old freshman Zoology I students of both sexes who were in their first regular university enrollment during the fall semester of the 1958-1959 academic year. Participation was voluntary.

The basic statistical treatment was that of correlation, involving zero-, first-, and second-order correlations and multiple correlation.

The null hypotheses tested were: (1) There is no significant correlation between the total raw-scores of the subjects on the departmental Zoology I examinations and their total raw-scores on the two tests of critical thinking; (2) Total raw-scores of the subjects on the two tests of critical thinking will not be of value as predictors of success in Zoology I; (3) Total raw-scores of the subjects on the three other standardized tests will not be of value as predictors of success in Zoology I.

Conclusions drawn from the study may be summarized as follows:

(1) The first null hypothesis may be rejected, in that the coefficients of correlation between the Zoology I examination raw-scores and those on the <u>Watson-Glaser Critical Thinking Appraisal</u>  $(r_{15} = .38)$  and the <u>Test of Critical Thinking</u>  $(r_{16} = .52)$  are significant at the .05 level of significance.

(2) The second null hypothesis may be rejected, in that regression equations were developed whereby the success of future Zoology I students of the same population as the subjects might be predicted with a standard error of estimate of 14.88 per cent from the Test of Critical Thinking, Form G, with a standard error of estimate of 16.18 per cent from the raw-scores on the Watson-Glaser Critical

Thinking Appraisal.

(3) The third null hypothesis may be rejected in that total raw-scores on The University of Oklahoma Mathematics Placement Examination may be used to predict success in Zoology I for students of the same population as the subjects with a standard error of estimate of 14.5 per cent. The Ohio State University Psychological Examination may be used with a standard error of estimate of 15.18 per cent, and The Iowa High School Content Examination with a standard error of estimate of 17.15 per cent.

Microfilm \$2.00; Xerox \$4.20. 77 pages.

# ORGANIZATION, PRESENT PRACTICE AND CHANGES IN ELEMENTARY SCIENCE PROGRAMS

(L. C. Card No. Mic 59-3059)

Frederick Milton Brandow, Ed.D. University of Southern California, 1959

Chairman: Professor Naslund

The purpose of this study was (1) to determine the various plans of elementary science organization, (2) to report on the use and desirability of the plans of general and internal organization, (3) to describe the present status of science education with reference to availability and organization of courses of study or guides, availability of textbooks, state and local legal requirements, typical approaches to teaching science and factors contributing to unsatisfactory teaching of science, and (4) to describe the recent, imminent, and desired changes and factors retarding change in elementary science programs.

A review of the available literature and research studies was made to determine the types of organization and trace the development of elementary science programs. This review pointed out a need for a comprehensive list of the plans of science organization, as well as a need for pertinent research data pertaining to the status of elementary science programs. Therefore, a questionnaire was constructed and sent to all state departments of education and selected cities throughout the forty-eight states. In addition, personal interviews were conducted with leading advectors in eighteen states.

educators in eighteen states.

Conclusions. From an analysis of the findings the following conclusions were drawn pertaining to organization.

(1) The separate subject plan is most widely used, but more consideration needs to be given to the integration and correlation of materials particularly in the upper grades. (2) Where conditions permit, more extensive use

of the integrated plan seems desirable at all grade levels.
(3) Any use of the incidental or nature study plans as the basic plan of organization would be undesirable. (4) The separate subject, integrated and correlated plans are most desirable. (5) Much more use of the problem plan of internal organization is desired at all levels. (6) The topical plan is being used more extensively than is desired. (7) The biography plan is the least used and desired.

Several conclusions regarding the present status was reported. (1) Legal requirements were too general and limited in number to be effective as guides in planning science programs. (2) There is much need for extensive work in developing science courses and guides. (3) The textbook is the most widely used basis for science programs. (4) The multiple adoption of texts is desirable, but practiced by few. (5) Lack of effective communication between the state departments of education and local districts was evident. (6) Factors contributing most to the unsatisfactory teaching of science were those dealing with the teacher's own personal qualifications. (7) Many teachers are not following the general approach to teaching science advocated by their local school systems.

The following conclusions regarding changes were drawn. (1) Many changes have been made in such areas as course development, in-service training, and increased emphasis on science; and even more progress can be expected in these areas in the immediate future. (2) A variety of desired changes were reported, ranging from more emphasis on the scientific method to more provision for the gifted child. (3) Few legal limitations exist which would prevent making desired changes. (4) There is much need for re-evaluation and improvement of teacher-training programs. (5) More adequate financing at state and local levels is needed to provide for the additional supervisory help, facilities, and materials needed to operate successful elementary science programs.

Recommendations. This study has shown that elementary science has not been made a required subject in the curriculum of many elementary schools. Therefore, it was recommended that each state department and city prepare a planned, continuous science program which begins in the kindergarten and includes appropriate materials from all fields of science and places major emphasis on the use of the scientific method. Additional specific recommendations were made, and the need for constant reevaluation was pointed out. Further recommendations for research were suggested to supply additional data needed for continued improvement of elementary science programs.

AN ANALYSIS OF THE STATUS AND NEEDS WITH SUGGESTIONS FOR IMPROVEMENT OF INDUSTRIAL ARTS EDUCATION IN THE PUBLIC SECONDARY SCHOOLS OF ARKANSAS

Microfilm \$5.10; Xerox \$17.00. 399 pages.

(L. C. Card No. Mic 59-3038)

Joe Underwood Davenport, Ed.D. University of Arkansas, 1959

Major Professor: Roy W. Roberts

Purpose: The purpose of this study was to determine the status of industrial arts education in Arkansas; to examine

the effectiveness and needs of existing programs; to ascertain the nature of plans in progress for improvement and expansion of industrial arts programs; and to make recommendations for further improvement.

Method of Research: All schools in the state known or thought to have programs of industrial arts were visited. Information blanks were filled out by school administrators, teachers and pupils in each school offering industrial arts. Questionnaires were mailed to 200 schools not offering industrial arts to determine their plans for the future. The responses received were analyzed to accomplish the purpose of the study.

Summary: Industrial arts was taught by sixty-four teachers in forty-six schools in twenty-five districts in Arkansas in 1958-59. The schools providing industrial arts had a total enrollment of 32,185 with 6,298 students enrolled in industrial arts. Of the sixty-four teachers, three had no degree; forty-six held the bachelors degree only; and thirteen had completed the requirements for both the bachelors and masters degree. Salaries of industrial arts teachers ranged from less than \$3,000 to over \$5,000 with a median of approximately \$3,800. Salaries of teachers with the masters degree averaged about \$900 higher than those with the bachelors degree only and the salaries of teachers with no degree were about \$900 less than the salaries of those with the bachelors degree only. Of the schools offering industrial arts, 62.5 per cent offered general shop industrial arts courses. Over 75 per cent of the administrators rated the accomplishments of all of the listed objectives of industrial arts education as average or above. The objectives rated lowest by the administrators were the study of the organization, processes, products and occupations of industry, and the development of recreational and hobby activities. Teachers and students generally agreed in their evaluation of the accomplishment of the listed objectives of industrial arts in terms of student behavior and classroom activities. Chi square tests showed significant differences in the ratings of the two groups in only six of the thirty-five items rated. Eighteen schools reported that plans were in progress to make changes for the improvement or enlargement of their industrial arts programs. The changes most frequently planned were to provide new school buildings to include new shop facilities and to provide additional areas in general shop. Of the 146 schools not offering industrial arts which returned the industrial arts survey questionnaire, thirty-three schools had plans for beginning industrial arts programs in the near future. Most administrators felt that industrial arts programs were needed in their schools.

Conclusions: Most industrial arts teachers in Arkansas had completed adequate professional preparation. The majority of the industrial arts teachers received their college preparation in the state of Arkansas. Salaries of industrial arts teachers were generally higher than the salaries of other teachers in the secondary public schools. Relatively few clubs and extra-curricular activities were organized and sponsored by industrial arts teachers. Industrial arts was required in a very small percentage of the schools. Administrators felt that industrial arts teachers were proficient in meeting the stated objectives of industrial arts.

Recommendations. The requirements for certification of teachers should include the completion of bachelors degree with courses in shop work, mechanical drawing and professional courses in industrial education. Industrial arts teachers should participate in activities contributing to their professional growth. Extra-curricular activities and leisure and hobby activities in industrial arts areas should be increased. Operation of the industrial arts program should be included as a specific item in the school budget. Some experience in industrial arts should be available to all students. Unit shop courses should be replaced by general shop programs in the junior high schools. Most classes should be limited to about twenty students.

Microfilm \$3.30; Xerox \$11.40. 256 pages.

# THE EFFECT OF INTERESTING AND NONINTERESTING COPY MATERIAL ON SPEED AND ACCURACY IN TYPEWRITING

(L. C. Card No. Mic 59-3543)

Glenna Ardath Dodson, Ed.D. The University of Florida, 1959

The purpose of this study was to determine whether or not the use of interesting copy material in typewriting would produce greater speed and accuracy than would the use of noninteresting copy material. Interesting copy material for boys and girls was prepared. These materials were judged by 52 male and 77 female high school students to be more interesting than the timed writings taken from typewriting textbooks. The textbook timed writings were rated as noninteresting by these same students.

Two timed writings, taken from the 6th Edition of 20th Century Typewriting by Lessenberry and Crawford, were administered to determine base speed and accuracy scores for the students participating in the performance part of this study. The series of ten interesting timed writings for boys, ten interesting timed writings for girls, and ten noninteresting timed writings were administered to groups randomly selected from 23 second semester, first-year high school typewriting classes.

The data were analyzed in terms of individual achievement on the series as compared with base scores. The amount of increase or decrease in speed was found to be significant statistically when the t test was used, and the amount of increase or decrease in the number of errors was found to be not significant statistically.

The group of students using interesting copy material decreased in speed an average of .83 gross words per minute and increased in errors an average of .99 errors in three minutes, from the base scores for this group. The group of students using noninteresting copy material increased in speed 1.29 gross words per minute and increased in errors 2.04 errors in three minutes, from the base scores for this group.

Microfilm \$2.00; Xerox \$6.00. 123 pages.

THE AMERICAN CAREER OF MICHAEL J. DEMIASHKEVICH

(L. C. Card No. Mic 59-3494)

George Keiser Evans, Ph.D. George Peabody College for Teachers, 1959

Major Professor: William H. Vaughan

### Purpose of the Study

The purpose of the study was to draw an accurately documented and objective picture of the American life and thought of Michael J. Demiashkevich, a distinguished writer and teacher in the fields of comparative education, the philosophy and history of education, and international politics.

#### Sources of Data

1. Personal interviews. The following sixteen individuals who knew Dr. Demiashkevich personally or professionally were asked to recollect their association with him: Dr. Boris B. Bogoslovsky of the Russian Language Section of the United Nations; Dr. Anna Bowie, a prominent physician of Nashville, Tennessee; Dr. Alfred Hall-Quest, formerly Editor of The Kadelpian Review and The Educational Forum; Bessie B. Harris, Emeritus Associate Editor, The Peabody Reflector and Alumni News; Dean Henry W. Holmes, Professor of Education, Emeritus, Harvard University; Dr. I. L. Kandel, Professor Emeritus of Education, Teachers College, Columbia University; Dr. William H. Kilpatrick, Professor Emeritus of Education, Teachers College; Dr. Oliver J. Lissitzyn, Assistant Professor of Public Law, Columbia University School of Law; Rabbi Julius H. Mark, Senior Rabbi of Congregation Emanu-El, New York City; Florrie Mathis, Branch Records, Consultant, Remington Rand of Nashville; Dr. Richard C. Peck, Professor of English, Middle Tennessee State College; Mrs. A. I. Roehm, widow of the late Dr. Roehm, Professor of the Teaching of Modern Languages, Emeritus, of Peabody College; Dr. Milton L. Shane, Professor of Modern Languages, Peabody College; Dr. Louis Shores, Dean, The Library School, Florida State University; Dr. Fremont P. Wirth, Professor of History, Emeritus, Peabody College; and Dr. Robert Ulich, James Bryant Conant Professor of Education, Harvard University.

2. All the American publications of Dr. Demiashkevich.

3. Extant correspondence and unpublished manuscripts of Dr. Demiashkevich. Materials used were contained in: the files of the Russian Student Fund, Inc., of New York; the faculty files of George Peabody College for Teachers; an extensive and hitherto unavailable personal file; and various other sources.

# Treatment of Data

The treatment is biographical. After a brief resume of Michael J. Demiashkevich's background, the study presents a survey of his days as a student at Teachers College, Columbia University, 1923-1927, and a discussion of his return trip to Europe, 1927-1929. A review of his activities as a member of the faculty of Peabody College from 1929 to his premature death in 1938 follows. His connection with the Essentialist Movement is also discussed.

Interspersed in the chronological review of Dr. Demiashkevich's life are presentations of the gist of his thought as presented in the books and articles written by him. Microfilm \$5.70; Xerox \$20.00. 447 pages.

THE DETERMINATION OF THE DEGREE OF TENSIONS PRODUCED IN SELECTED WHITE STUDENTS WHEN PRESENTED WITH CERTAIN BELIEFS AND FACTUAL MATERIALS PERTAINING TO NEGROES

(L. C. Card No. Mic 59-3039)

Geneva Zenobia Facen, Ed.D. University of Arkansas, 1959

Major Professor: Dr. R. K. Bent

#### I. THE PROBLEM

This investigation was conducted to determine the degree of tensions produced in selected white students when presented with certain beliefs and factual materials pertaining to Negroes.

The subjects were 50 students selected from five classes in the College of Education, University of Arkansas.

The problem suggested three hypotheses which formed the basis for the investigation: (1) Judges can concur as to the degree and kind of observable tensions produced in selected white subjects; (2) there is no relation between attitude and tensions; and (3) there is no relation between attitude and number of responses during a discussion pertaining to Negroes.

#### II. THE METHOD

Several weeks prior to the actual presentation and discussion periods, 121 students were asked to indicate their reactions toward Anglo Americans, Latin Americans, and Negroes on the Purdue Scale, which contains 64 items designed to measure attitudes. Reactions to Anglo Americans and Latin Americans were included in order to secure measures of control.

Scores on this scale, computed for attitudes toward Negroes, formed the basis for the selection of subjects to be observed. The subjects were unaware that they had been selected for the investigation or that a formal investigation was in progress. Those selected were determined by three judges who based their selections on the students' scores on the Purdue Scale. High scores represent favorable attitude toward the race being measures, and low scores unfavorable. There was an attempt to select an equal number of males and females, and to select those who would constitute a continuum, that is, a continuous range of scores from one extreme to the other.

Fifteen judges were employed in this experiment. Each presented materials and made judgments in more than one section. Before the presentation, each was given a copy of the resource unit "The American Negro" from which each prepared a discussion, and a copy of the seating chart and a list of observable reactions to tensions. They were instructed to observe the subjects' tension reactions during

the discussions and to record them on the seating charts as well as the number of times the subjects participated in the discussion.

On the days assigned, teams of two judges presented the discussions to the subjects. The regular teacher introduced the topic and there were always two judges who had a chance to observe reactions and record them on the seating chart. Questions which followed were directed to anyone of the three who constituted a panel.

The hazards involved in diagnosing reactions from outward manifestations were reduced by not disclosing to the judges the attitude toward Negroes held by the subjects under observation.

The measure of tension evidenced by the individual during the experiment (a subjective measure), was related to the objective measure (attitude toward the Negro), as recorded on the Purdue Scale.

The discrepancies between objective and subjective data were checked by establishing the reliability coefficients between and among the observations recorded by the judges as to the degree of tension shown by certain subjects, and tested at the one per cent confidence level.

### III. FINDINGS AND CONCLUSIONS

The major thesis of this study was that tensions would be created during a discussion pertaining to Negroes. This assumption was based on the idea that different attitudes toward the Negro would produce varying degrees of tension, which could be objectively measured.

All of the hypotheses were accepted.

Hypothesis I. The reliability coefficients of the judges' records of tension reactions were .63, .70, .51, .44, and .15. The reliability coefficients of the average ratings for three judges observing each group were .84, .86, .76, .90, .70, and .90. When these coefficients were tested for reliability, they were well within the 5 and 1 per cent level of confidence limits.

Hypotheses II and III. There is no relation between attitude and the number of responses, and attitude and tension during a discussion pertaining to Negroes. Negative coefficients of correlation of -.16 and -.05 were obtained for both of these relations when determined for 50 subjects. Positive, though low, correlations were found to exist in Group 1 between attitude and response, (.40), and attitude and tension reaction, (.29). Each of the four remaining groups had low, but negative, coefficients of correlation. At the 5 and 1 per cent levels of confidence, these values are not significant.

# IV. IMPLICATIONS

Emotinoal reactions of pupils, especially those who have a basis in attitudes toward some race, are among the most important responses for teachers to observe. Different attitudes produce varying degrees of tension, which can be objectively measured. Since these attitudes are a combination of emotions and capacities, future investigations may result in the abstraction of these functions from the total personality. If the key could be found to the unique combination or patterning of these factors and their consistency with one another, it could form the basis for methods of instruction for teachers interested in the attitudes their pupils are acquiring as well as factual information and other skills. Microfilm \$2.00; Xerox \$6.60. 139 pages.

ANALYSIS OF ACCURACY OF SPELLING IN WRITTEN COMPOSITIONS OF ELEMENTARY SCHOOL CHILDREN AND THE EFFECTS OF PROOFREADING EMPHASIS UPON ACCURACY

(L. C. Card No. Mic 59-3359)

James E. Goss, Ed.D. The University of Oklahoma, 1959

Major Professor: William B. Ragan

The purposes of this study were (1) to determine the extent to which spelling errors in written compositions are due to factors other than lack of knowledge of correct spelling; and (2) to determine the effect of consistent teaching of and practice in proofreading upon accuracy in written compositions.

An experiment involving 543 fifth-grade pupils and their homeroom teachers in selected elementary schools of Tulsa, Oklahoma, provided the data presented in the study.

Each pupil involved was asked to spell the words he had misspelled in a composition which he had written.

Eight classes were designated as a control group; eight comparable classes comprised an experimental group. The experimental group was given special instructions and experiences in proofreading for a twelve-week period, and the control group was given no special emphasis or instruction in proofreading for the same period of time. An effort was made to employ proofreading emphasis as a variable, thus permitting its possible influence to be examined critically.

Each pupil was asked to participate in two types of proofreading activities at the beginning and at the end of the experimental period in order that a measure could be made of performance change. These activities were (1) proofreading an exercise which was previously prepared in cursive writing by the investigator, and (2) proofreading compositions written by the pupil at the beginning and at the end of the experimental period.

The principal findings were as follows:

- 1. The pupils tested were able to spell correctly 55.4 per cent of the words misspelled in the written compositions.
- 2. At the end of the twelve-week period the experimental group showed significant improvement in ability to discover spelling errors in cursive writing exercises prepared by the investigator. The control group showed no significant improvement in proofreading prepared exercises.
- 3. Both groups showed significant improvement in discovering errors in their own compositions. Although the experimental group showed greater change in performance, the difference in performance of the two groups was not great enough to prove conclusively that the emphasis on proofreading was responsible for the difference.

Recommendation:

- 1. It is recommended that a program stressing proofreading be carried on for a longer period of time in order to give more practice in applying proofreading techniques to one's own work.
- 2. It is further recommended that the study might well include consideration of the effects of emphasis on proof-reading upon reading rate.

Microfilm \$2.00; Xerox \$5.60. 114 pages.

THE EFFECT OF OMITTING WORKBOOK-TYPE READING READINESS EXERCISES ON READING ACHIEVEMENT IN THE FIRST GRADE

(L. C. Card No. Mic 59-3495)

Milo Levelle Haynes, Ed.D. George Peabody College for Teachers, 1959

Major Professor: Harold D. Drummond

#### Purpose

The purpose of this study was to try to discover through a controlled experiment whether omission of workbook-type experiences for developing particular skills as a part of a reading readiness program had any significant effect on reading achievement in the first grade.

#### Procedure

The experiment involved 120 white first grade children. Sixty of these children did not take part in the reading readiness activities as outlined in the reading readiness book developed by the publisher of the basal reading series used in Webster Parish, Louisiana. Instead, these children took part in activities that would give the children many concrete learning experiences. An equal number of children with comparable ability according to readiness tests, I.Q. scores, and age took part in the rather intensive program of reading readiness exercises and drills designed to develop reading readiness and published in the reading readiness books. Standardized achievement tests were given to both groups at the end of the year. The groupswithin-treatments design described by E. F. Lindquist was used to test for significance. Teacher differences were controlled statistically by using this procedure.

#### Results

Under the conditions of this experiment and on the basis of the results of the achievement tests, the conclusion was reached that there was no significant difference in achievement in reading between the two groups taught by the different methods.

Implications, Speculations, and Recommendations

On the basis of this experiment it appears that children will not necessarily achieve less in reading in the first grade if they do not take part in a formal program of developing reading readiness through the use of the reading readiness books. No implications should be drawn, however, that readiness for reading is not essential.

Speculation at this point would suggest that before a child reaches the maturity level which is required for the mechanics of reading, the task of learning these mechanics is hard and retention is low. Once the required maturity level is reached, these same mechanics are learned with ease and little or no practice is required prior to actual reading instruction.

In the light of the findings of this study and from this speculative point of view, some recommendations are made to first grade teachers concerning the readiness period of instruction. Discarding immediately all the reading readiness books is not advocated. However, the teacher

should not become a slave to reading readiness books-allowing these books to dictate what must be done each day. Instead, the teacher is advised to become master of the reading readiness books, using them as she feels they are needed as one of the tools in the trade, and putting them aside when she feels they are not necessary. The teacher's efforts should be away from trying to develop abilities that the children do not yet have and toward maximum use of the abilities the children already have.

No suggestion is made or implied that the readiness activities used by the classes not using the reading readiness book were the ultimate in an alternate reading readiness program. There is little doubt that other teachers would have provided other, and perhaps, richer firsthand learning experiences. However, this experiment indicates that experiences designed to enrich learning experiences, which take the children out of the classroom and which bring interesting materials into the classroom, should certainly be utilized by all teachers.

Microfilm \$2.20; Xerox \$7.80. 167 pages.

FROM CLASSROOM ACTION TO EDUCATIONAL OUTCOMES: AN EXPLORATION IN EDUCATIONAL THEORY

(L. C. Card No. Mic 59-3198)

Dwayne E. Huebner, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Paul W. Eberman

The study develops a conceptual scheme designed to facilitate understanding of the relationship between action in the elementary classroom and the educational outcomes of such action. The need for such a study arises from difficulties encountered by the educational researcher as he tries to relate variables in the classroom situation to changes in pupil behavior, and from problems encountered by the instructional theorist as he tries to help teachers structure the learning situation to achieve desired objectives.

The major problem in the development of such a scheme is that of conceptual consistency. Three systems of concepts are necessary for the educator to move from classroom action to valued outcomes. First, he must have concepts which make possible the organization of perceived classroom action. Second, he must have concepts which permit him to express, and handle in thought, the valued outcomes which either guide the action situation, or result from the action situation. Finally, because a cause and effect relationship is postulated between action and outcomes, a theoretical matrix linking the two must be available; in this case a learning theory. To facilitate movement in thought from action to outcomes, it is assumed that the concepts used in each of the three systems must originate from a common base.

In this study, the common base which is established is the notion of the interaction patterns linking the individual and the environment. These patterns, which might be instrumental, expressive, or relational are made possible through the functioning of the motor, sensory, and autonomic nervous systems. The effectiveness of the sensory EDUCATION

and motor systems is increased as the individual internalizes cultural tools which are available in his society. From this conceptualization of behavior, concepts for categorizing educational outcomes and classroom action are derived. Since educational outcomes are usually assumed to be changes in individual behavior, it follows that the major changes in interaction patterns are also the categories of educational outcomes. Likewise, this conception of behavior suggests major categories for guiding observation of classroom action. These observational foci are supplemented by categories concerned with the decision making and communicating processes in the classroom. A conception of the learning process is then presented which emphasizes the recurring nature of certain elements in the individual-environmental complex, the intent of the learner to control these elements, and the discovery and feedback processes which help him establish interaction patterns with these recurring elements.

By bringing together categories for organizing classroom action and learning concepts, certain focal points in
the classroom action situation are suggested which facilitate understanding of the relationships between classroom
action and educational outcomes. These focal points are:
the potentially recurring conditions in the classroom, the
means by which these recurring conditions are established,
the intent of the learner toward these conditions, the discovery process which the learner uses to establish appropriate patterns, and the feedback processes used to

identify and fixate these patterns.

As the study is theoretical throughout, conclusions are drawn in terms of certain hypotheses concerning relationships between aspects of classroom action and potential behavioral outcomes. Furthermore, the suggestion is made that continued research in this area be focused on learning experiences in a given area such as social studies or science. By focusing research on a given experience area, it should be possible to keep interrelationships between categories of action and categories of outcomes in some sort of perspective, hence permitting cross checking of the concepts and their validity.

Microfilm \$2.85; Xerox \$9.80. 218 pages.

# THE EDUCATIONAL CONCEPTS OF EMILE DURKHEIM

(L. C. Card No. Mic 59-3114)

Jack Burkehart Krail, Ph.D. Columbia University, 1959

The subject of this dissertation is an examination description and analysis of the educational concepts of David-Emile Durkheim. The purpose is to focus attention on the educational thought of an outstanding scholar whose ideas were representative of many in the generation of young French intellectuals who attempted to rejuvenate their country after the Franco-Prussian War of 1870-71. Since much of their effort to renew France's sense of mission was exercised through the system of national schools they helped construct, a study of the educational thought of one of the leading members of this groups, is, in effect, an examination of a vital aspects of French culture.

The educational concepts of Durkheim expressed a combination of four diverse elements: traditional French

belief in intellectual training, modern sociological theory, conservative opposition to change without mesure or a sense of the possible, and non-theistic morality. Durkheim's analysis of these four elements and his unconscious personal bias led him to assign two principal functions to education: (1) the means by which the old socialized the young and thereby humanized them, and (2) the protection and perpetuating of Society. The education that put these functions into practice had three distinctive characteristics. First, education was a structure of Society and therefore was rightfully controlled, directed and supervised in all its various aspects by Society itself. Second, this education was a non-individualistic structure in that it directed its primary effort at fitting man to Society rather than adjusting Society to man. In spite of this characteristic, Durkheim believed in the essential dignity and worth of the individual. He reasoned that man was free and had rights, but only to the extent that Society willed. Unless Society was supported by all its members, it would disappear, and with it, there would vanish all the benefits conferred on man by that very structure (Society) which at once controlled and protected him. By being non-individualistic, education was in reality perpetuating the only structure that permitted man the right to be an individual. The third characteristic of durkheimian education was that it was universal only in that each Society had an educational structure. Only the functions of education were universal; all else pertaining to it -- theory, content, practice, ideals--were the products of a specific Society.

Moral and intellectual training were basic to Durkheim's educational theories. The former was the sinequa-non of Society, for without a system of values, and the teaching of these values to the young, Society could not exist. These values were not characterized by intrinsic qualities; rather, each Society decided which acts were moral, and then had the principles these acts implied taught to the young it was educating. Intellectual training reflected traditional French educational doctrine: the mind could be trained and would be strengthened through training. Durkheim believed this development necessary if man were to acquire the ability to understand morals and to evolve new standards of morality as Society demanded them. Intellectual training was directed at producing a citizen who possessed both the materia (the factual data) and the tools to reason a problem through to its

logical conclusion.

Finally, though Durkheim wished to retain the best of the past, he did not advocate retention of the status quo. The values of the past would be respected and protected to the extent that they were valid for the present. The authoritarianism implicit in Durkheim's thought was directed at providing man with controls that he himself evolved and then accepted because they were the expression of his collective will and were essential to his proper functioning in his particular Society.

Microfilm \$3.40; Xerox \$11.60. 261 pages.

AN ANALYSIS OF THE PHONEMES OF ENGLISH SPEECH WITH INSTRUCTIONAL MATERIALS FOR TEACHING THEM TO NON-ENGLISH-SPEAKING PERSONS

(L. C. Card No. Mic 59-1367)

George H. Owen, Ed.D. Wayne State University, 1958

Supervisor: William E. Hoth

This dissertation is in two parts: Part One summarizes, first, the development of current concepts in the teaching of foreign languages, and, then, linguistic research on the sound system of English on which Part Two, a textbook for teaching English sounds, is based.

The Detroit Board of Education has offered classes in English for non-English-speaking adults since 1875. The teaching method used in these classes has been, since 1920 at least, the "direct method" in which the only language used in the classroom is English. The basic approach in the Detroit program, which is similar to many programs throughout the United States, has been to teach a student to read, write, and speak English from the written form of

the language.

Since World War II, increasing emphasis has been placed on the use of the spoken language in foreign language learning. The work of Agard, Dunkel, and others has outlined the areas in which early aural-oral approaches to language learning were inadequate. Many of the successful developments in foreign language teaching in the last decade have grown out of attempts to meet these inadequacies. A rapidly growing body of specialists affirm that language is spoken, that writing is secondary to the spoken language, and that students learning a second language must first practice the spoken language until their use of it is reduced to the level of unconscious habit. A student learning to speak English as a foreign language must master the sound system of the language, its structural system, its limited number of function words, and enough of its content vocabulary to meet the needs of daily life.

A vast amount of linguistic research over the last forty or fifty years has resulted in an increasingly precise, scientific description of the phonology, morphology, and syntax of English. The conception of the phoneme as a significant cluster of sounds within the sound system of a language has made it possible to isolate, describe, and teach those sounds which a person learning English as a second language must be able to recognize and produce easily. Most linquists classify English phonemes into two groups: segmental, the actual sounds, and suprasegmental, the manner in which the sounds are spoken.

The segmental phonemes consist of nine simple vowel sounds, three semivowel movements, and twenty-one consonant sounds. A group of complex vowel sounds is produced by combinations of the simple vowel sounds and the semivowel movements. The suprasegmental phonemes consist of four pitches produced by four relative levels of voice frequency; four stresses produced by four relative degrees of voice loudness; and four junctures, or breaks in the stream of speech, each made distinctive by the way in which the voice dies out at the juncture. The sound system of English develops from the linking of the individual segmental phonemes modulated by the interaction of the suprasegmental phonemes.

A textbook for teaching the sound system of English to non-English-speaking persons forms Part Two of the dissertation. The segmental and suprasegmental phonemes are presented sequentially in fifty-seven lessons. The pronunciation of each phoneme is explained, then illustrated with charts or drawings. Each lesson contains three exercises in which the sound being learned is first presented in words of one syllable, then in polysyllabic words or short phrases, and finally in sentences. Every lesson has review exercises in which minimal pairs of words give the student practice in pronouncing contrasting sounds. A group of lessons presents most of the consonant combinations heard in English in initial, medial, and final positions in words. Microfilm \$4.55; Xerox \$15.40. 356 pages.

### A METHOD OF TEACHING JUNIOR HIGH SCHOOL ENGLISH GRAMMAR BASED ON SPECIFICS

(L. C. Card No. Mic 59-987)

Samuel Nathan Stott, Ph.D. University of Alabama, 1958

To show how certain facets of junior high school punctuation and grammar can be isolated, studied, and developed into a nomenclature is the intent of this study. The criterion for selecting language specifics that will most readily give rise to certain concepts is not discussed at length. Neither are criteria for helping pupils select relevant specifics. Therefore, the primary purpose of this study is to show how pupils can be guided to develop concepts from preselected specifics; the secondary purpose is to show how pupils can be led to develop a nomenclature for "a concepts surmised from specifics."

To help the pupils do this, the segments of punctuation and grammar discussed are generally divided in three categories: the first is an Exercise with Specifics; the second is a Follow-up; and the third is termed Establishing a Nomenclature. Every initial example in each Exercise with Specifics contains the principle being sought. This Exercise also contains questions designed to help the pupils glean some aspects of the rule or definition that is

contained in the examples.

The Follow-up continues the probing that is begun by the questions in the Exercise with Specifics. When it is felt that the commonality governing the given function of the given grammatical element under study is conceived, use is made of comparison. At this stage, comparison does not confuse. By serving as a tester it helps to etch more implicity the unique perspective of the new concept. Thus, when a new concept is juxtaposed with other specifics, it may be confirmed, may be only partially confirmed, or may be proved false.

All of the sentences and the questions germane thereto in the Specifics and the Follow-up are intended to help the pupils perceive some given function of punctuation or grammar that is common to the examples in the Specifics, but perceiving is not sufficient. The pupils are led to give form (a definite form) to the new concepts in the section called Establishing a Nomenclature—thus the exact nature of the concept developed from studying the Specifics is

further crystalized.

Each Exercise with Specifics begins with suggested activities that can be performed easily. These activities

are based on the common familiar vernacular of the junior high pupil. The Follow-up exercise and the exercise called Establishing a Nomenclature attempt to lead the pupils progressively from the obvious to the concept--from the known to the unknown is the pattern.

The National Council of Teachers of English says, "Long before children can name the parts of speech they have learned to use them to communicate meaning, . . . . . . . . . . . . . . . . . More specifically, when junior high school pupils hear the sentence Bill ran very fast, they know that the sentence talks about Bill; they know that ran tells what Bill did; fast tells how Bill ran, and very tells how fast he ran. This study attempts to use such knowledge to develop concepts.

Many of the specifics in the exercises of this study are carefully structured to help the pupils make the optimum use of contextual clues. The initial sentences in the exercises dealing with punctuation are written in a manner that exhibit clearly the use of or need for some given mark of punctuation. Such clues are also evident in the sentences that are used to develop grammatical concepts.

Microfilm \$3.30; Xerox \$11.20. 254 pages.

1. National Council of Teachers of English, The English Language Arts (New York, 1952), p. 283.

### AN APPRAISAL OF BUSINESS EDUCATION IN THE URBAN AND RURAL PUBLIC HIGH SCHOOLS OF THE STATE OF WASHINGTON

(L. C. Card No. Mic 59-3352)

Weston Clarence Wilsing, D.B.A. University of Washington, 1959

Chairman: Dr. J. Robert Briggs

#### Problem

It was the problem of this study (1) to describe, analyze, and evaluate business education in the urban and rural public high schools of the state of Washington and (2) to make recommendations for its improvement.

Procedures Used and Scope of Study

Interviews were conducted during the school year 1955-56 with public school administrators and business teachers in a carefully determined judgment sample of fifty-seven schools. Ninety-seven employing units were also visited and interviews held with approximately 150 businessmen.

Other procedures included observation of classes; scrutiny of annual accrediting reports submitted to the state department of education; review of the content of textbooks; and analyses of class schedules, registration bulletins, and other materials.

Business education in both urban and rural public high schools was analyzed in terms of its (1) objectives; (2) organization and administration; (3) subject offerings and curricula; (4) plant and equipment; (5) materials, methods, and standards; (6) student personnel services; (7) problems; and (8) achievements.

# Appraisal of Business Education

Important shortcomings revealed by comparing conditions and practices in Washington high schools with criteria established in professional literature stemmed from:

- 1. Absence of close school-community relationships;
- Lack of emphasis on the economic understanding and consumer competency objectives;
  - 3. Lack of proper supervision at all levels;
- 4. Inadequate curricular organization and content for achieving the vocational objective;
- 5. Insufficient number and variety of office machines, inadequate typewriter desks, and poor distributive education facilities; and
- 6. Inadequate provision for the selection, guidance, placement, and follow-up of business students.

In the main, the public high schools were providing the tupes of business education that businessmen wanted and expected. However,

- 1. Some employers scored the public high schools for not providing specialized office machines instruction and distributive education;
- 2. Many complained that the schools were not turning out enough employable graduates in the occupational areas for which they were furnishing training; and
- 3. Most cited the weaknesses of high school products particularly in attitudes, character traits, and the fundamentals. Accuracy in typewriting, how to act in an office, and how to apply for a job also needed improvement.

In terms of achieving the objectives which public school administrators and business instructors had set for business education, the investigator's conclusions were that:

- 1. The prevocational objective was being attained quite well;
- 2. The goals of preparing students for beginning office and distributive positions; of equipping them with business skills and knowledges for their personal use; of providing guidance of an exploratory nature; and of making contributions to improved skills in communication and computation were being accomplished only partially; and
- 3. The aims of developing occupational intelligence, consumer competency, and general business understanding were generally not being attained.

#### Recommendations

Of the many recommendations set forth for improving business education, perhaps the most important were the appointment of a state director of business education and the provision of special supervisors in large school systems. Qualified personnel in these positions would provide the leadership for effecting many of the changes proposed in this dissertation.

# **Unusual Findings or Contributions**

- 1. Uncovered were the "limited vocational" and "accommodation" objectives, neither of which has been identified in the professional literature.
- Classification of country high schools into urban fringe and isolated led to the finding that important differences in objectives, means of accomplishing goals, and even problems existed between these two types of rural schools.
- 3. Relatively speaking, business education attained a prominence in the rural high schools of the state equal to or greater than that attained in the city schools.
- 4. Businessmen often indicated that they were not satisfied with the general business understanding of young high school graduates. Yet the understandings that many employers wished to see developed differed from the usual content of economics or business principles courses.

Microfilm \$5.65; Xerox \$19.80. 443 pages.

#### ENGINEERING

ENGINEERING, CHEMICAL

IGNITION OF COMPOSITE ROCKET PROPELLANTS.

(L. C. Card No. Mic 59-2988)

Alva Daniel Baer, Ph.D. University of Utah, 1959

Chairman: Professor Norman W. Ryan

The ignition of four composite rocket propellants was studied by a shock tube technique and in a thermal radiation furnace. For both methods of study, the ignition was characterized by the observed ignition delay times; the propellant ignition was detected photoelectrically. Heat transfer rates to the propellant surfaces were estimated with the help of supplementary heat transfer studies.

For the shock tube tests, the hot high-pressure gas stagnated by the reflected shock wave was used as an energy source for heating the solid propellant. This gas was passed across the propellant surface, heating the surface to the ignition temperature. A special shock tube technique was used to give testing times of 40-60 msc. A 1-7/8-inch i. d. shock tube was used with a short driven section (11.3 feet) and a long driver section (52.4 feet). Matched driver gas and driven gas interfaces were obtained by employing mixtures of helium and air as the driver gas. Following the initial pressure rise as the incident shock wave reflected, the pressure at the sample position increased in 2-3 msc to about 130 per cent of the initial rise and then remained nearly constant for 40-60 msc.

Propellant ignition times of 5-45 msc were measured by means of this shock tube technique. Air, nitrogen, and oxygen were used in the driven section, and tests were made with incident shock Mach numbers of 2-4 and final gas pressure of 150-400 psia.

In the thermal radiation furnace tests, ignition data were obtained by subjecting propellant samples to the thermal radiation of the isothermal interior of a specially constructed furnace. Propellant ignition times of 19 to 0.2 seconds were measured with furnace temperatures of 1000 to 1770°K. Air, nitrogen, and oxygen at atmospheric pressure (12.5 psia) were used in the furnace interior.

The ignition criterion suggested by B. L. Hicks, which expresses in analytical form the postulate that, at the time when propellant ignition occurs, the rate of energy release at the propellant surface due to exothermic propellant reactions becomes comparable to the rate of external heat transfer to the surface, was used to develop a relationship between the propellant ignition time and the surface heat flux. This relationship permits the ignition reaction activation energy to be estimated from the experimental variation of the ignition time with the surface heat flux. The ignition data from the shock tube tests and from the radiation furnace work were well correlated when plotted as suggested by this relationship.

A comparison of the results of the propellant ignition study with the shock tube to the results obtained with the radiation furnace showed (a) that the estimated propellant ignition reaction energy (E/R) for the ammonium perchlorate based propellants from the shock tube tests (15,000°K) was about one-half the value for the radiation furnace tests (30,000°K-40,000°K), (b) that the propellant ignition times using the shock tube technique were shorter for a given surface heat flux than the radiation furnace data extrapolated to the same heat flux, and (c) that the ignition in the radiation furnace appeared to be associated mainly with the oxidizer decomposition while the binder seemed to be important in the shock tube tests. In the two apparatus the mechanism of ignition was apparently different, possibly because of the order of magnitude difference in ignition times.

For the shock tube tests, oxygen in the driven gas significantly reduced the propellant ignition times. The composition of the gas in the radiation furnace was found to have no measurable effect on the ignition times, perhaps because the oxygen pressure was quite low (12.5 psia).

In the present study, transient heat transfer theory in conjunction with a thermal ignition model explained and correlated the experimental ignition results over a wide range of propellant ignition times. In general, transient heat transfer theory should be useful in correlating and interpreting many types of solid propellant ignition data.

Microfilm \$2.30; Xerox \$8.00. 174 pages.

1. B. L. Hicks, "Theory of Ignition Considered as a Thermal Reaction," Jour. Chem. Phys. 22, 414 (1953).

HOLDUP AND PRESSURE DROP WITH GAS-LIQUID FLOW IN A VERTICAL PIPE.

(L. C. Card No. Mic 59-3076)

Gordon Albaugh Hughmark, Ph.D.
Louisiana State University, 1959

Supervisor: Professor Bernard S. Pressburg

Vertical upward cocurrent air-liquid flow was investigated with a test section of one inch schedule 40 pipe. Pressure drop was measured with a mercury manometer connected to two pressure taps 20 ft apart in the section. The liquid under test was used as the seal fluid on the mercury. Two solenoid valves supplied air to two quick shut-off valves outside the pressure taps. Liquid drained from the section between the valves provided the holdup data. Six liquids were used in the investigation to determine the effect of liquid density, viscosity and surface tension.

The experimental holdup and pressure drop data could not be correlated with the Lockhart-Martinelli correlation

for horizontal flow. Mass velocity was shown to be an important variable that is not considered in their correlation.

A correlation for holdup was developed to include physical properties of the fluids, total mass velocity and mass flows entering the pipe. Liquid volume fraction in the pipe was correlated with a function x.

$$x = \frac{W_{L}^{0.9}}{W_{G}} \frac{\mu_{L}^{0.19} \sigma^{0.205} \rho_{G}^{0.70} \mu_{G}^{2.75}}{G^{0.435} \rho_{L}^{0.72}}$$

W = mass rate entering pipe, lb/sec.

G = total mass velocity, lb/sq ft sec. When G exceeds 50, a value of 50 is used

 $\mu$  = viscosity, centipoises

 $\rho$  = density, lb/cu ft

 $\sigma$  = surface tension, dynes/cm

sub L = liquid

sub G = gas

The correlation is in close agreement with the experimental and literature data. The results indicate that holdup is independent of pipe diameter in the range of 0.4 to 2.34 inches.

A pressure drop correlation was developed in which the two-phase pressure drop is a function of the difference in velocity between the two phases in the pipe with parameters of  $\psi$ .

$$\psi = \frac{1}{G^{0.70} \mu_L^{0.147} \sigma^{0.194}}$$

G = total mass velocity, lb/sq ft sec.

 $\mu_L$  = liquid viscosity, centipoises

σ = surface tension, dynes/cm

Correlation with literature data for 0.5 and 2 inch pipe indicates that  $\psi$  is inversely proportional to the square root of the pipe diameter. An average percentage error of less than 15% was obtained with the correlation between the observed data for total pressure drop and the calculated pressure drop data.

Microfilm \$2.00; Xerox \$5.20. 104 pages.

HEAT AND MASS TRANSFER DATA FOR CONDENSING PURE AND BINARY VAPOR MIXTURES OF PARAFFINIC AND AROMATIC HYDROCARBONS.

(L C. Card No. Mic 59-3078)

Habib Labbauf, Ph.D. Louisiana State University, 1959

Supervisor: Professor Bernard S. Pressburg

Methods and data for applying Nusselt's equation to the condensation of binary vapors have not been satisfactorily established. No data are available on heat- and mass-transfer coefficients for condensing binary hydrocarbon vapors which form a single-phase condensate; the vapor-

liquid interface temperature needed in calculating these coefficients is still subject to definition, although limited experimental data have indicated that the bubble point of the condensate may be taken as the interface temperature. The purpose of this study is to obtain experimental data that could be used to answer these and other questions quantitatively, so that more satisfactory methods can be established for the design of condensers.

Condensation data were collected by varying the temperature drop across the condensate film covering the range from 10 to 35°F; a constant composition of condensate was maintained during each series of tests. Systems studied were: benzene-n-heptane, n-heptane-toluene, and n-hexane-toluene; the mixtures tested covered a wide concentration range of each.

Heat-transfer coefficients were calculated using as the temperature difference, that between the condensing surface: and the vapor temperature, the dew point and the boiling point of the condensate, and the interfacial temperature. The coefficients based on the interfacial temperature and the bubble point of condensate were usually intermediate between the coefficients for the pure components when the two temperatures were close, as would be expected. However, those based on the vapor temperature and the dew point were not.

A study was made also to determine the manner in which the heat-transfer coefficients varied with composition, for various constant temperature differences. Coefficients for binary systems can be predicted with satisfactory accuracy at relatively high temperature drops, based on the bubble point of the condensate, by assuming a linear variation of coefficients with composition (expressed as mole percent) between the values of the pure components at the same temperature drop. The departure from linearity, greatest at low temperature drops, may be related to the fractionation efficiency of the condensation, whether the condensation is total, equilibrium, or between these two types.

Interpretating the data in terms of mass transfer indicated that appreciable resistance to heat and mass transfer existed in both the vapor and liquid phases. For most mixtures the liquid-phase resistance to mass transfer was more than 50 percent of the total resistance, which is contrary to the past assumption that it was absent. The smaller gas-phase resistance indicated that most of the mass was transferred bodily rather than by diffusion.

When the liquid-phase resistance to mass transfer was not controlling the interface composition was almost the same as the condensate composition and the calculated interfacial temperature was closer to the bubble point of the condensate than to either the dew point or the vapor temperature. However, when the resistance was appreciable, composition of the condensate and the interface differed markedly as did the two temperatures.

Enrichment of the residual vapors was 30 to 80 percent of that predicted by the equilibrium diagram for the condensate composition. The higher the ratio of the individual gas-phase resistance to the over-all gas-phase resistance, the higher the degree of enrichment. Also the enrichment was directly related to the number of over-all gas-phase transfer units — which varied from 0.4 to 1.5. However, only at low enrichment does a given percentage increase in the number of transfer units effect approximately the same increase in enrichment.

The over-all height of a gas-phase transfer unit, Hog,

varied with composition from 0.4 to 1.6 Ft. For the three binary systems,  $H_{og}$  showed a minimum value and became large as the binary mixtures became concentrated in either components.

Microfilm \$3.10; Xerox \$11.20. 255 pages.

THE KINETICS OF THE CATALYTIC DEHYDRATION OF CERTAIN TERTIARY AND LONG CHAIN PRIMARY ALCOHOLS.

(L. C. Card No. Mic 59-3202)

James Russell Laible, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Charles C. Watson

The catalytic dehydration of alcohols to produce an olefin and water was investigated. N-amyl and n-hexyl alcohols were studied at 450° F., 550° F., and 650° F., and t-butyl alcohol was studied at 250° F., 300° F., and 350° F. At each temperature, for each alcohol, experimental data were taken at four pressures covering the range of atmospheric to 90 psig.

Silica-alumina catalyst of -28+35 Tyler Mesh was used. Catalyst activity was found to change with use, and the experimental data were adjusted to account for this

Cracking and polymerization were found to occur to a negligible extent, but no ethers were detected. Experimental data were corrected for small, but measurable,

amounts of dehydrogenation.

The dehydration reaction rate was found to be controlled by a single site surface reaction controlling ratemechanism. The four constants of the rate expression-effectiveness factor, surface reaction rate constant, and reactant and product adsorption constants—were determined by graphical analyses.

The surface reaction rate constants showed the following order of reactivity: n-amyl alcohol < n-hexyl alcohol < t-butyl alcohol. There was no indication that the activation energies of the normal alcohols were approaching a limit, as might have been expected on the basis of the increased inductive effect of the alkyl groups. The activation energies did not appear to be a function of the type of alcohol being investigated. The adsorption constants of the normal alcohols increased with increasing chain length of the alcohol, and the adsorption constants of the product water appeared consistent within the limits of the experimental method.

Experiments on t-butyl alcohol were carried out near saturation at the experimental temperatures and pressures. Since the graphical analysis applies strictly to a gas phase reaction, the final analysis was made excluding the experimental data that might have been affected by partial condensation of the reactant feed in the catalyst bed and by capillary condensation inside the catalyst itself.

Microfilm \$2.70; Xerox \$9.40. 208 pages.

ENGINEERING, CIVIL

ESTIMATION OF HIGHWAY NEEDS FOR COUNTY PRIMARY ROAD SYSTEMS IN MICHIGAN AND MINNESOTA BY SAMPLE SURVEY METHODS.

(L. C. Card No. Mic 59-2216)

Donald Orville Covault, Ph.D. Purdue University, 1959

Major Professor: Harold L. Michael

Highway needs studies are costly and time consuming and require large engineering staffs for their performance. Sample survey methods can be used to reduce the time and work required to make these studies.

Complete inventory and cost data were available for the primary county road systems in Michigan and Minnesota and this information was used for statistical analysis. The rural and urban systems in each state were composed, respectively, of separate highway, bridge, and railroad crossings populations. A composite population composed of highway sections and bridge and railroad crossings located in the respective highway sections was also used. The total value of population characteristics and the variances of these characteristics was computed.

Four different sampling methods were investigated for required sample size using five different combinations of margin of error and  $\alpha$  risk for the respective populations. The methods investigated were:

- (a) Simple random sampling
- (b) Optimum and proportional stratified random sampling
- (c) Simple cluster sampling
- -(d) Optimum and proportional stratified cluster sampling

Using a specified margin of errors and  $\alpha$  risks for each population, sample sizes required for the estimate of total cost were computed. Sample sizes required for the estimation of other population totals were also computed. Optimum stratified random sampling required minimum sample sizes compared to sample sizes required for proportional stratified random sampling and simple random sampling for the estimate of total cost. Optimum stratified cluster sampling required minimum sample sizes for the estimate of total cost compared sample sizes required for all other forms of cluster sampling.

For a given margin of error and  $\alpha$  risk for each population all forms of cluster sampling used for the respective populations required substantially larger sampling rates for the estimate of the total cost than those required for simple random or stratified random sampling. For all forms of sampling used, optimum stratified random required the smallest rates and simple cluster sampling required the largest.

Estimated sample survey costs required for the estimate of total cost using the rural separate and rural composite populations for five orders of accuracy were investigated for each sampling method studied. For all sample survey methods using the separate populations, minimum total sample survey costs were generally given by optimum stratified random sampling for the Michigan and Minnesota data. Simple random sampling required minimum total sample survey costs for the rural Minnesota composite population. For the rural composite Michigan population, simple random sampling required the smallest expenditure of funds for the three lowest orders of accuracy. However, for the two highest orders of accuracy, minimum sample survey costs occurred using optimum stratified random sampling.

The apparent difference in estimated total sample survey costs for simple random and optimum and proportional stratified random sampling for the respective composite and separate populations was small. All forms of cluster sampling required much larger expenditures when compared to the expenditures required for simple random or stratified random sampling for the various orders of accuracy studied.

The amount of information which can be obtained from the composite samples was more limited than the information which was obtained from the separate samples. However, a 70 to 150 percent increase in estimated sample survey cost occurred for the separate samples when compared to estimated cost of the composite samples for a specified order of accuracy.

Microfilm \$5.00; Xerox \$16.80. 392 pages.

# CONFIGURATION OF SHELL STRUCTURES FOR OPTIMUM STRESSES.

(L. C. Card No. Mic 59-3384)

Howard Paul Harrenstien, Ph.D. Iowa State College, 1959

Supervisor: Glenn Murphy

General characteristic differential equations which describe the surface that a shell structure must adopt in order that it resist prescribed normal pressure loads under constant membrane stress are developed.

An analogy is introduced which yields solutions to these differential equations for any problem which admits certain loading and boundary conditions. This analogy is considered particularly desirable for cases where closedform mathematical solutions are difficult to obtain.

Solutions of the characteristic equations by mathematical methods and by the proposed analogy are presented for two examples. These examples involve shell structures circular and square in plan which are subjected to a concentrated load.

Plaster-of-paris shell structures were built to the dimensions predicted by the above solutions. These shell structures were tested to observe the strains and deflections under the design load. Results of these tests are compared with theoretical values based on the application of the principles of similitude and strain energy.

Microfilm \$2.00; Xerox \$4.60. 90 pages.

### ENGINEERING, ELECTRICAL

A STUDY OF PREDICTOR-RELAY SERVOS WITH RANDOM INPUTS.

(L. C. Card No. Mic 59-3168)

Thomas Ralph Benedict, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Vincent C. Rideout

Feedforward prediction compensation in relay servomechanisms is the subject of this thesis. Test inputs are members of a stationary Gaussian random process, and the load is considered to be primarily inertial. It is assumed that a given "torque" level is available. The problem then, is to find the prediction compensation and switch computer circuitry that will minimize the mean squared error.

An approximate phase plane design proposal is evaluated and compared to existing relay servo designs, by simulation of the system and various random inputs on a high-speed analog computer. The approximate design is then subjected to computer optimization to determine its degree of success in minimizing the mean squared error. Significant further reductions in error are found. By placing increased weight on the predicted input derivative, the optimum circuitry is made relatively free from dependence upon input signal level. Computer test data reveal the effect of different input power spectral densities as well as input signal levels. It is found that for all the relay servos studied, the relative width of the spectral power distribution influences the error more severely than does band location. This is especially true of the predictor-relay servo where prediction quality deteriorates rapidly with spectral bandwidth.

The method of the Fokker-Planck equation as used by Chuang and Kazda in a 1959 paper is extended to provide the solution for the error probability distribution function. This function is found for a class of compensated relay servos. The asymptotic behavior of this important function is found to be of a single simple form for a wide class of predictor-relay servomechanisms. Thus once the mean squared error is known, the probability of error exceeding a given level is easily determined without detailed system study. Theoretical results on this problem are verified by experiment on the analog computer.

Microfilm \$2.00; Xerox \$6.80. 145 pages.

# REVERSIBLE POLARITY POWER AMPLIFICATION WITH SWITCHED SEMICONDUCTOR DEVICES.

(L. C. Card No. Mic 59-3239)

Theodore Bernstein, Ph.D. The University of Wisconsin, 1959

Supervisor: Norbert L. Schmitz

The original purpose of this investigation was to develop an amplifier circuit with a d-c reversible polarity output. A search of the literature and experimental investigation indicated that such a magnetic amplifier circuit

has an inherently low efficiency — less than 50 per cent. Efforts to improve the efficiency led to the development of an amplifier circuit using switched transistors con-

trolled by low power magnetic amplifiers.

Switched transistors are used in the high efficiency reversible polarity circuit. These transistors are controlled by magnetic pre-amplifiers. Methods are developed for overcoming the problem caused by the exciting current of the magnetic pre-amplifier. This exciting current prevented the transistors from being switched completely off and thus caused transistor heating and a quiescent balancing problem. Tests of the circuit indicate its relatively high efficiency and its practicality as a reversible polarity output amplifier. One major difficulty encountered with this circuit is that the transistors are driven out of their saturation region when the load resistance is low. The problem can be minimized by increasing the base drive in order to return the transistor to its saturation region but then the magnetic pre-amplifier must be larger.

The silicon controlled rectifier circuit eliminates the problem of load impedance variation driving the semiconductor device out of saturation. Once the controlled rectifier has fired, it has a low forward voltage drop until the voltage reverses or the forward current falls below 10 milliamperes. The problem of exciting current is not critical in this case since the magnetic amplifier exciting current through the gate lead can be kept at a value small enough to prevent rectifier firing by using small magnetic amplifier cores or by shunting of the gate-cathode junction. The identical circuit used for the transistor reversing circuit could not be used for the controlled rectifier because of difficulties in regaining control of the rectifiers. The circuit developed has an efficiency as good as that for the switched transistor circuit and eliminates the voltage regulation problem caused by low resistance loads. In addition, silicon controlled rectifiers are available for use at elevated temperatures.

The silicon controlled rectifiers also appear suitable for a demodulator circuit. This circuit was used in the development of a constant frequency source using an alternator whose field current was modulated at the desired output frequency. Demodulation of the alternator output provides the constant frequency power in spite of alternator speed variation. Test and analysis indicate that a polyphase alternator provides the smoothest demodulated output, but most tests were conducted using a single phase alternator because it was the only 10 kc machine available. The circuit developed was capable of delivering 500 watts output. The limit of its output was determined by the rating of the silicon controlled recti-

fiers. Operation at 10 kc influences the rating of the

silicon controlled rectifiers because of the heating pro-

duced by the sweep-out phenomenon. This is a charac-

teristic of all large area semiconductor rectifiers operat-

ing at high frequency.

Of the three circuits developed, the most immediately applicable circuits are the reversible polarity d-c output circuits using either switched transistors or controlled rectifiers driven by magnetic pre-amplifiers. These circuits should find wide use in servomechanism systems because of their inherently rapid response. The power output is only limited by the state of the semiconductor art.

Microfilm \$2.00; Xerox \$6.60. 137 pages.

THE USE OF A FREQUENCY DISCRIMINATOR TO DETERMINE THE MEAN FREQUENCY OF NARROW-BAND NOISE IN THE PRESENCE OF WIDE-BAND NOISE.

(L. C. Card No. Mic 59-3822)

Harris A. Stover, Ph.D. State University of Iowa, 1959

Chairman: Professor L. A. Ware

A description is given of an experimental study of the use of the frequency discriminator as a device for tracking the mean frequency of a symmetrical narrow-band noise spectrum in the presence of broadband noise. The sensitivity of the discriminator and the standard deviation of the discriminator output voltage were measured for a large number of different conditions. For these measurements the rms voltage level of the narrow-band noise was maintained constant while the narrow-band noise width, the broadband noise level, the discriminator filter spacing, and the discriminator filter width were changed. The results are exposed in a series of graphs of the measured values. These results indicate that there are preferred areas of discriminator adjustment that are dependent upon the operating conditions, but in most cases this adjustment is not very critical.

Microfilm \$2.00; Xerox \$6.40. 135 pages.

SPECIALIZED Z-FORM STEADY-STATE
ANALYSIS OF LINEAR AND NONLINEAR SYSTEMS.

(L. C. Card No. Mic 59-3293)

Keith Duane Struthers, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor T. J. Higgins

The aim of this thesis is to develop a discrete numerical procedure, which provides a means more flexible and easier to use than any developed to date, for facile determination of the steady-state periodic responses of a nonlinear system to a periodic forcing function.

This aim is accomplished in three major steps. First, a numerical steady-state operational analysis is developed for determining the steady-state periodic response of a linear system to an arbitrary periodic forcing function, with especial attention to the case that the periodic input is given graphically or numerically and a similar description of the output is required. Second, the steady-state analysis is joined with an iterative technique to afford determination of the desired steady-state periodic response of a nonlinear system to an arbitrary periodic forcing function. Finally, application of this body of theory is illustrated in all details through determination of the responses of various appropriately selected linear and nonlinear electric circuits and automatic control systems.

This method is based on use of the "z-forms" developed by Boxer and Thaler for the transient analysis of linear and nonlinear systems.

The need for such an easily-effected analysis is

indicated in the shortcomings revealed by examination of the limited procedures now available.

The scope of this thesis is as follows: Chapter 2 comprises a concise summary of the main features of z-form analysis as pertinent to use in the following chapters. Chapter 3 contains a discussion of the transient responses of nonlinear systems. Chapter 4 details account of the procedure advanced for the numerical steady-state operational analysis for obtaining the steady-state periodic response of a linear system to an arbitrary periodic input. Chapter 5 comprises an account of application of the numerical steady-state analysis to the difficult problem of directly determining the steady-state periodic response of a nonlinear system to an arbitrary periodic input. Chapter 6 contains a summary and conclusions. A list of pertinent references concludes the thesis.

The essential values of the results of this thesis can be summarized as follows: A discrete numerical technique is advanced for optaining directly the steady-state periodic response of a linear system to an arbitrary periodic forcing function, with especial attention to the case that the periodic input is given graphically or numerically. A new technique is given for solving the difficult problem of directly obtaining the steady-state response of a nonlinear system to a periodic input. Two methods are presented. Method I, based on use of a recurrence equation requires the graphical solution of two simultaneous equations. An easily-effected procedure for accomplishing this is given. Method II, based on use of a division technique, does not require the graphical solution of two simultaneous equations: however, in general more iterations are required to obtain the final solution than by Method I. The periodic input can be given graphically, numerically, or analytically.

The technique advanced should prove of especial usefulness for the steady-state periodic analysis of nonlinear systems. All points of theory and the course of application of the various techniques advanced in this thesis are well-illustrated by solution of various linear and nonlinear systems typical of those in practice; and the rapidity of use of the method and the accuracy of the resulting solutions are explored by comparison with corresponding values furnished by exact solutions when available, or otherwise by comparison with values obtained by machine solution.

Microfilm \$2.05; Xerox \$7.20. 153 pages.

ENGINEERING, MARINE

ROLL DAMPING DUE TO BILGE KEELS.

(L. C. Card No. Mic 59-3808)

Milton Martin, Ph.D. State University of Iowa, 1959

Chairman: Dr. Louis Landweber

The high degree of effectiveness of bilge keels in damping the roll of ships at zero and low speeds is shown to be due to the exceptionally high values of drag coefficients resulting from the oscillatory motion. Measure-

ments of the mean drag coefficient of oscillating flat plates of infinite length-width ratio attached to a heavy pendulum were made. The results show that the mean drag coefficient is practically independent of Reynolds number but varies considerably with dimensionless oscillation amplitude  $X_o/b$ , where  $X_o$  is the amplitude of oscillation and b is the half width of the plate. The measured drag coefficients vary from 13 at  $X_0/b = 0.2$  to 3.4 at  $X_0/b = 9$  and presumably must approach the steady value of 1.9 at very large values of X<sub>o</sub>/b. The data from these experiments are used to predict the roll damping due to bilge keels of 20 ship models for which measurements exist. Good agreement is obtained in general except for a few cases of models with unusually sharp bilges and small bilge keels where high "counter currents" at the bigges account for greater effectiveness of the bilge keels.

It is shown how this remarkable variation in drag coefficient with oscillation amplitude is related to the rate of growth of the vorticity at the edges of the plate. The high drag coefficients at small values of oscillation amplitude are attributed to that part of the low pressures associated with the initial growth of these vortices in phase with the plate velocity. Photographs showing the vortices becoming detached and moving laterally away from the edges of the oscillating plate presumably depict the manner in which the damping energy is transmitted from the plate to the fluid. Estimates of the contribution of wave making of the bilge keels to roll damping at moderate roll angles are also made and found to be small in comparison to that attributable to eddy making.

In order to explain the effectiveness of bilge keels on roll damping underway the bilge keel is treated as a wing of very low aspect ratio. An expression, based on the rate of growth of the vorticity at the side edges of the wing, is derived for the non-linear part of the lift curve for wings of very low aspect ratio. This is shown to agree well with existing data on such wings. Application of this expression to the prediction of roll damping underway due to bilge keels yields extinction curves somewhat lower than measurements. The high degree of non-linearity of the lift curve is thought to account for this in two ways. First, there may be an appreciable unsteady effect on the lift and second, it is possible that the bilge-keel angle of attack oscillated about some angle other than zero. Finally, an underestimate of the bilge "counter current" and distance to the roll axis of the bilge keel would contribute to the difference.

The results of computations of the relative contributions to roll damping from frictional resistance, eddy making and wave making for the twenty models are also presented. Microfilm \$2.00; Xerox \$4.00. 71 pages. ENGINEERING, MECHANICAL

A FAST INFRARED PYROMETER FOR ENGINE COMPRESSION TEMPERATURES.

(L. C. Card No. Mic 59-3173)

Marshall Chester Burrows, Ph.D. The University of Wisconsin, 1959

Supervisors: Professors P. S. Myers and O. A. Uyehara

An infrared pyrometer for the measurement of gas temperatures in the combustion chamber of an internal combustion engine was developed and experimentally tested. The infrared pyrometer is similar in principle to those utilizing the reversal principle, but because it uses water vapor as the sensing element is sensitive to the lower temperatures associated with the fuel and air mixture before it is ignited by the spark plug. Details of its theory are presented.

The water vapor band at 2.7 microns wavelength was selected for the absorbing and emitting medium inside the combustion chamber. It appears to remain in thermal equilibrium with the other component gases and therefore should give a true indication of the instantaneous gas temperatures. The study of this wavelength region of the infrared spectrum and particularly that of water vapor are discussed.

The required optical and electronic components of the infrared pyrometer were evaluated and chosen for (a) maximum transmission of radiation, (b) reasonable cost and size, (c) ruggedness and insensitivity to vibration, and (d) the required frequency response to follow the temperature fluctuations in the engine combustion chamber. The final instrument was tested under both motored and fired engine conditions to assure proper function and adequate signal. A steady-flow system was constructed to provide high-velocity air through a duct at temperatures between 700° R. and 1200° R. Readings of temperature by the infrared pyrometer were compared with temperatures measured by a thermocouple probe and thermocouples in the walls of the duct. Results of these experiments pointed out the method of operation of the infrared pyrometer that would provide the most accurate and reproducible readings of gas temperatures.

A series of engine runs were made with the infrared pyrometer mounted on a conventional C.F.R. variable-compression engine using two different methods of recording data, photographic and direct-reading. The merits of each recording method are discussed and a comparison of the data is made.

Gas temperatures measured by the infrared pyrometer were compared directly with those measured by a sonic-velocity method developed at Massachusetts Institute of Technology on a specially designed combustion chamber. Comparative data are presented and the relative merits of the two methods are discussed.

Microfilm \$3.45; Xerox \$11.60. 265 pages.

EFFECT OF FUEL-IMPINGEMENT-SURFACE TEMPERATURE ON NOISE, SMOKE, AND POWER OF A COMPRESSION-IGNITION ENGINE.

(L. C. Card No. Mic 59-2633)

Lawrence Richard Daniel, Jr., Ph.D. Michigan State University, 1959

Major Professor: Louis L. Otto

The intention of this investigation was to determine experimentally the effect of impingement-surface temperature on smoke, noise and power in a compression-ignition engine combustion chamber in which there is combustion-surface fuel impingement.

A regular CFR Cetane engine was modified in such a way that, by use of a directional nozzle, the fuel spray could be directed either toward a combustion chamber wall or out into the open combustion chamber space. The combustion chamber consisted of a small cylindrical space located in the cylinder-head and was offset from the centerline of the bore. An investigation of air-flow in this chamber using paint-patterns and a small paddle-wheel finally led to the development of a combustion surface in the form of a protruding lip in the bottom of the combustion chamber. The fuel was injected onto this lip and the vapors produced thereon were picked up by the currents of air from the compression process.

Spheroidization of the fuel was investigated on the assumption that within the engine a combustion surface might exist on which the fuel would spheroidize rather than spread as a smooth film. It was found that deposit formation on this combustion surface occurred so rapidly at higher surface temperatures that this system would not successfully operate within the temperature range at which spheroidization would seem to be a problem.

Deposit formation caused increasingly more trouble as the temperature of the impingement surface was increased. It was concluded that the distance between the injector nozzle and the impingement surface was somewhat critical, in that too small a distance would allow diversion of the fuel spray by the deposits prior to its complete spreading on the lip, while too large a distance would allow a large portion of the fuel to autoignite and cause a louder combustion noise.

It was found that the beneficial effect of an impingement surface on noise and smoke increased as the surface temperature increased. At the higher surface temperatures, however, deposits quickly formed and the beneficial effect of the surface was reduced. For this engine it was found that the optimum surface operating temperature was in the neighborhood of 500°F. Above this temperature the smoke became worse, power dropped off and noise tended to increase, depending on the manner in which the deposits formed. Below this temperature both noise and smoke quickly became unreasonable.

The effect of compression ratio on the surfaceimpingement system in a compression-ignition engine such as this one was similar to that of the normal spaceimpingement system. For compression ratios between 16:1 and 22:1 it was found that smoke became worse, power increased, and noise decreased as the compression ratio was increased. Higher compression ratios than 22:1 gave excessive smoke. The original fuel-impingement compression-ignition engine as developed by Dr. J. S. Meurer, known as the M-system combustion chamber, utilizes fuel impingement in a hemispherical combustion chamber and evaporation of this surface film into a controlled air-swirl. It was concluded that the system originated herein is not a true M-system combustion chamber. In the true M-system the reaction rate is low at the beginning of combustion and increases towards the end of combustion while in this "lip" engine the maximum rate of pressure change occurs nearer the beginning of combustion.

Microfilm \$2.00; Xerox \$6.20. 129 pages.

# PLATE VIBRATION WITH TIME DEPENDENT BOUNDARY CONDITIONS.

(L. C. Card No. Mic 58-5818)

Jewett Earl Foster, Ph.D. State University of Iowa, 1958

Chairman: Associate Professor Robert L. Sutherland

This paper is concerned with the solution for amplitude of a rectangular vibrating plate with various edge conditions and time dependent boundary conditions. Time dependency is defined as the application of a sinusoidal forcing function to all edges of the plates considered.

Analytical solutions are presented for the three conditions of vibrating plates; all edges simply supported, two edges simply supported and the two opposite edges clamped, and finally all edges firmly clamped. In all cases the technique of complex clamping is applied to limit the amplitude at resonance.

To arrive at analytical solutions the procedure developed is to use a transformation on the differential equation and boundary conditions, which removes the time dependency but complicates the differential equation. However solutions can then be obtained by ordinary methods subject to the transformed boundary conditions. Finally the inverse transformation is applied to obtain the desired solution.

Experimental results are given for the simply supported plate as well as for the clamped case and it is shown these results check the analytical solutions rather closely. Microfilm \$2.00; Xerox \$5.60. 114 pages.

# ENGINEERING MECHANICS

DEVELOPMENT OF STANDARDS FOR THE MEASUREMENT OF VIBRATORY MOTION.

(L. C. Card No. Mic 59-3010)

Raymond Richard Bouche, Ph.D. University of Maryland, 1959

Supervisor: Professor John E. Younger

During the past decade vibration measurements have become a very important part of the development of space vehicles, missiles, aircraft, ships, machines, etc. There is a continuing demand for improving the accuracy of vibration measurements. The basis of accurate measurements is the primary vibration standard. This thesis presents the work done in developing primary standards for the calibration of vibration pickups at frequencies up to 2000 cps and accelerations up to ten times the acceleration of gravity.

The standard consists of an electrodynamic vibration exciter equipped with a velocity-sensing coil which is calibrated by the reciprocity method. The standard subjects vibration pickups to rectilinear sinusoidal motion and is substantially free of transverse motion. This performance is achieved by vibration isolating the moving parts from the frame of the standard by a tensioned-wire suspension system.

The sensitivity of the primary standard is constant and unaffected by pickup mechanical impedance at frequencies up to nearly 1000 cps. The presence of an axial resonance below 2000 cps changes the sensitivity of the standard above 1000 cps. The change in sensitivity depends upon the mechanical impedance of the vibration pickup attached to the standard. The reciprocity calibration determines the sensitivity as a function of pickup mechanical impedance, provides a means for measuring the mechanical impedance of a pickup, and therefore determines the sensitivity of the standard to be used during the calibration of each pickup. The presence of this resonance decreases slightly the accuracy above 1000 cps, but has the advantage that it increases the obtainable acceleration.

The vibration standard is used in the recently established calibration service at the National Bureau of Standards. This calibration service is currently being used to calibrate vibration pickups submitted by government and industrial research laboratories. Seismic electrodynamic velocity and piezoelectric acceleration vibration pickups calibrated on the standard provide reasonably accurate secondary vibration standards for use by these laboratories. However, a small coil used with a seismically mounted magnet is a more accurate transfer secondary vibration standard.

Microfilm \$2.00; Xerox \$4.60. 87 pages.

TORSION OF RECTANGULAR SANDWICH PLATE.

(L. C. Card No. Mic 59-3177)

Shun Cheng, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Gerald Pickett

A theoretical analysis of the problem of a rectangular sandwich plate subjected to a torsional moment produced by forces acting at two corners of one end and supported at the corners of the other end is presented. The sandwich plate consists of two facings and a core. The facings are considered to be isotropic solid membranes of equal thickness and the core is treated as an orthotropic elastic solid of negligible stiffness in the plane of the sandwich plate. Continuity of displacements and stresses at the boundaries of facings and core are preserved. The edges of facings and the core are made free of boundary stresses by a multiple Fourier procedure which results in simultaneous linear equations.

Results from this method are compared with results from a solution based upon the simi inverse method of Saint Venant. In the Saint Venant solution torsional rigidity is independent of the coordinate of length. Torsional rigidities as computed by the two methods differ appreciably for short sandwiches, the difference depending on the elastic constants of the core since the Saint Venant solution is independent of two of the three elastic constants characterizing the elastic properties of the core.

Results are obtained for different distributions of the corner forces including that of a concentrated force at each corner and forces uniformly distributed over small rectangular areas near the corners.

The numerical work was done on an IBM 650 and programs are available by which results for other dimensions or properties of materials than those investigated can be readily obtained.

Microfilm \$2.00; Xerox \$3.00. 46 pages.

THE EFFECTIVE ELASTIC CONSTANTS OF PERFORATED PLATES AND SHELLS.

(L. C. Card No. Mic 59-3245)

Robert Adrian Daane, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Raymond J. Roark

A method is presented for determining the effective elastic constants for a perforated plate with a doubly periodic distribution of circular holes subjected to a condition of plane stress. These effective elastic constants are obtained from the numerical solutions for the Airy stress function which satisfy the boundary conditions at each hole when the plate is subjected, successively, to three independent systems of plane stress.

The method of analysis is based on Schwartz's Algorithm for the general two dimensional boundary value problem with a multiply connected region. The two dimensional theory of elasticity in complex variable form as presented by Muskhelishvili is used.

Numerical values of the effective elastic constants for some hole pattern examples, computed according to the proposed method, are presented. These results agree with experimentally determined values. The results for these examples also show that the effective elastic constants, as determined by the frequently used method of analysis of a model in which the perforated plate is replaced by a network of beams, may be highly erroneous.

It is demonstrated experimentally that the uniform plane stress effective elastic constants may be used with good accuracy in the analysis of the deformations of a perforated plate or shell with a plane stress distribution which varies moderately from hole to hole. The plane stress effective elastic constants are also applicable to the analysis of bending deformations of perforated plates or shells provided that they are quite thick compared with the width of the perforated plate ligaments. A method of analysis is indicated for the determination of the effective elastic constants for the bending of perforated plates or shells which are thin compared with the ligament width.

Microfilm \$2.00; Xerox \$4.20. 77 pages.

ENGINEERING, METALLURGY

KINETICS OF COMMINUTION.

(L. C. Card No. Mic 59-3088)

Upendra Nath Bhrany, Eng.Sc.D. Columbia University, 1959

Existing theories of size reduction in tumbling mills have been unsatisfactory. Various formulae suggested for energy size-reduction relationships have been completely empirical and of limited application. The relationship between size distribution and energy consumed in fracture has never been brought out.

Kinetic considerations applied to size reduction in tumbling mills lead to a general rate equation relating rates of formation and size of product. The equation is shown to yield a more general size distribution function and is easily transformed to give most of the widely used empirical relations in size reduction. A relationship between energy and size reduction is developed from the rate equation which is completely general and is based on a phenomenological model. The relationship between size distribution parameters and parameters of energy size reduction equations is established for the first time. It is shown that the exponent n in the energy size reduction equations is closely related to the exponents in the rate and size distribution equations.

Rates of formation of products are shown to be related to power input. A relationship between rates of formation and mill and material characteristics is developed using the rate concepts and theory of dimensional analysis. The equations developed are tested by conducting controlled experiments on three different ball mills and are shown to be in good agreement with the results. The results of two other investigations are re-evaluated on the basis of rate concepts. These show a good correlation.

The kinetic concepts are shown to apply to continuous

tumbling mills, if there is little mixing in the direction of flow. Evidence is presented showing that very little mixing takes place in the direction of flow in tumbling mills. Results on continous milling from literature are recalculated and show a good correlation. The results further show that the micro rate phenomena are unaffected by ordinary changes in operating conditions. Energy input in tumbling mills is shown to be the major rate controlling parameter.

A definition of grindability is developed from rate considerations. Calculations indicate that the correlation between batch and continuous milling results is good both in the case of ball and rod mills.

Microfilm \$2.00; Xerox \$6.60. 139 pages.

### THORIUM-YTTRIUM ALLOY SYSTEM.

(L. C. Card No. Mic 59-3375)

David Terrington Eash, Ph.D. Iowa State College, 1959

Supervisor: O. Norman Carlson

The thorium-yttrium alloy system has been investigated by thermal, electrical resistance, x-ray and microscopic methods. On the basis of the data obtained from these investigations a region of complete solid miscibility exists at high temperatures, an allotropic transformation from a hexagonal close-packed to a body-centered cubic structure occurs in yttrium at  $1495^{\circ}$ C, a eutectoid reaction takes place at  $1375^{\circ}$ C and 25 wt. % yttrium and a maximum in the  $\alpha$ (Th) to  $\beta$  transformation occurs at  $1435^{\circ}$ C and approximately 6 wt. % yttrium. At room temperature the solid solubility limits of the  $\alpha$ (Th) and  $\alpha$ (Y) regions are approximately 20 and 30 wt. % yttrium respectively.

A preliminary survey of several mechanical, physical and corrosion properties of thorium-yttrium alloys showed only small deviations from the properties of the pure metals except for a sharp decrease in the ductility of thorium with a one wt. % addition of yttrium. This was followed by a large increase in ductility with an addition of 10 wt. % yttrium.

Microfilm \$2.00; Xerox \$5.60. 112 pages.

KINETIC STUDY OF NICKEL CORROSION
IN SULFURIC ACID AND CARBON DIOXIDE
ADSORBTION ON THORIA.

(L. C. Card No. Mic 59-2983)

Charles Horace Pitt, Ph.D. University of Utah, 1959

Chairman: Milton E. Wadsworth

The corrosion of nickel in sulfuric acid solutions in the temperature range of 75°C to 125°C and from 0 to 600 psi partial oxygen pressure was investigated. The variation of rate as a function of agitation, time, acid concentration, and partial pressure of oxygen was determined. The net reaction is:  $2Ni + H_2SO_4 + O_2 + 2H^+ = 2Ni^{++} + SO_4^- + 2H_2O$ .

The rate was found to be linear over the range of time investigated under the experimental conditions of this study and varied directly with oxygen concentration. A systematic variation of acid concentrations using buffered solutions indicated a process in which the undissociated sulfuric acid molecule plays an important part. Calculation of the activation energy for the process gave a value of approximately 4 kcal for the rate determining step. The rate determining step was considered to be the adsorption of oxygen on a site containing adsorbed H<sub>2</sub>SO<sub>4</sub>.

Carbon dioxide was adsorbed on samples of thoria having a surface area of 30 square meters per gram. The amount adsorbed was measured gravimetrically using a quartz spring and cathetometer. Adsorption isotherms were obtained for a series of temperatures after degassing at 650°C. Isosteric heats and enthalpy of adsorption were determined from the adsorption isothersm. The isotherms obtained may be explained by an adsorption process involving a linear variation of adsorption potential with surface coverage. Below approximately 200°C an unusual increase in adsorption is observed which can be explained by postulating the presence of two types of adsorption sites. A theoretical interpretation of results is given.

Desorption rate curves were obtained for carbon dioxide adsorbed on thoria at temperatures of 550°C, 450°C, 350°C, 250°C, 150°C, and 50°C. The gas was found to desorb according to a logarithmic law following initial rapid desorption. The logarithmic law may be shown to be operative if the activation energy for desorption varies linearly with surface coverage. A large apparent negative entropy of activation for desorption supports the fact that the adsorbed CO<sub>2</sub> is in a mobile state.

Microfilm \$2.00; Xerox \$3.00. 60 pages.

#### IMPULSIVE LOADING OF METALS.

(L. C. Card No. Mic 59-3306)

Owen Keith Shupe, Ph.D. University of Utah, 1959

Chairman: Melvin A. Cook

The end and side impulse action of high explosive charges was studied by observing the behavior of metals accelerated from the end or side of the charge. These investigations included studies of explosive shape and size, plate material and size, and the use of inert cushioning agents for reducing plate breakup. The technique of interrupting the detonation wave with a shock-pass heatfilter (SPHF), which was first described by Cook, Keyes and Filler, was applied in conjunction with plate velocity studies. These studies were concerned with the interaction between explosives and metals to aid in the design of continuous rod warheads.

Craters produced by the end impulse increased in volume with charge length until a steady state was reached at 3.5 charge diameters. Plate velocity studies for end and side impulse, and the measurement of the travel angle of plates propelled by side impulse showed the same steady state condition. These results are consistent with the "detonation head" model.

The theoretical velocities for end impulse were obtained by assuming a perfectly elastic collision between the detonation head and the plate. The experimental velocities which were measured by using the pin oscillograph with an appropriate pin-set were in good agreement with the theoretical velocities. The plate velocities measured were independent of the plate material, and depended only on the plate mass and not on impedance match of explosive to metal. This result is an important one in distinguishing between this model and the "free surface velocity" model.

Side plate velocities showed that the side impulse was less than the end impulse, and that the plates had a slower acceleration. The use of various inert solids for cushioning the plates produced reduced plate breakup and plate velocities, the amount depending on inert cushioning agent. The application of confinement produced less loss of impulse because of less side losses through the inert material.

The behavior of steel rods under explosive confinement was studied by observing axial tension fracture within the rod. When the cylindrical explosive had a diameter greater than a certain critical value, fracturing within the rod was prevented. Since the detonation head was large enough to maintain an applied pressure on the rod until the compression pulse in the metal reached the explosive-metal interface, no reflected tension pulse would be created to cause rod fracturing. The shock front would then pass from the metal into the detonation head because of the good impedance match between the metal and the detonation head. However, when the charge diameter was such that release waves in the explosive reached the surface of the rod before the pressure pulse, a tensile pulse was reflected back into the rod. On this basis it was found that the detonation head model accounted satisfactorily for the axial tensile fracture results observed.

Pellets and plates were propelled from charges containing glass plates as a shock-pass heat-filter (SPHF) for interrupting the detonation wave. This technique was used to reduce plate breakup while accelerating the plates. When plate velocities were measured as the glass thickness and receptor length were varied, velocities were obtained which showed that high pellet and plate velocities were obtained regardless of the length of receptor charge used. This indicated that even though no reinitiation of the receptor was indicated on the streak camera trace, there was some added impulse applied to the plate from the receptor charge, probably as a result of explosive deflagration.

Investigators at this laboratory have shown previously that SPHF charges require a critical minimum receptor length for detonation within the receptor. However, while measuring plate velocities, it was observed that receptor charges less than the critical minimum length, but with a metal plate on the free end, reflected the shock and caused detonation of the receptor, which in turn produced more gradual acceleration as well as increased velocity of the plate.

Microfilm \$2.00; Xerox \$4.80. 91 pages.

ENGINEERING, MINING

VOLTAGE- AND FREQUENCY-DEPENDENT IMPEDANCE VARIATIONS FOR SYNTHETIC METALLIFEROUS ORE.

(L. C. Card No. Mic 59-2985)

Robert Blair McEuen, Ph.D. University of Utah, 1959

Chairman: Dr. Joseph W. Berg, Jr.

Ninety small cores of synthetic metalliferous ore were constructed from solid glass spheres, lead spheres, and refractory cement. The lead sphere content of the synthetic ore varied from zero to 50 percent by frame volume. The effective porosity was controlled by the tamping pressure and ranged from 10 to 20 percent. The cores of synthetic ore were saturated with NaCl solution. The impedance of the cores of synthetic ore was measured with a modified Wheatstone bridge as a function of frequency and applied voltage. Phase shift data as a function of frequency and current density were obtained with a Z-Y type bridge. The low frequency applied-voltage-dependent impedance variation is separated from the over-all decrease of impedance with increase of frequency by taking advantage of the dependence of this effect upon the applied voltage. The over-all decrease of the impedance with frequency and the low frequency applied-voltage-dependent impedance variation are found to be dependent upon the effective porosity and the lead sphere content. Both the applied-voltage-dependent impedance variation and the over-all decrease of the impedance with frequency are shown to increase with decreasing porosity. The appliedvoltage-dependent impedance variation at 10 cps attained a maximum at approximately 15 percent lead spheres by frame volume. Theoretical dependence of the impedance on the chemical nature of the zone of transition from electrolytic to electronic conduction and on the magnitude of the dipole moment of the lead spheres is discussed. Equivalent circuits are presented which aid the interpretation of the observed impedance changes.

At a constant low frequency, the applied-voltagedependent impedance variation is given by an equation of the form

$$\mathfrak{F}_{\sharp} = \frac{1}{d + h \mathfrak{F}_{a}} + \mathfrak{F}_{\infty} \tag{1}$$

where d and h are constants whose values are dependent on the chemical kinetics associated with the zone of transition from electrolytic to electronic conduction,  $J_Q$  is proportional to the applied voltage, and  $J_Q$  is a value obtained by extrapolation to an infinitely large value of  $J_Q$ . The general form of equation (1) is justified by theoretical considerations.

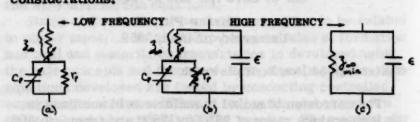


Figure 1
Equivalent Circuit for Electrical Conduction
Through Synthetic Ore

The equivalent circuit of Figure 1 is useful in the interpretation of observed impedance variations. In this circuit  $\epsilon$  is the high frequency permittivity (capacitance per unit length) of the synthetic ore. The nonlinear circuit elements are controlled by the chemical kinetics associ-

ated with the zone of transition from electrolytic to electronic conduction and by the magnitude and frequency of the applied voltage.

Microfilm \$2.00; Xerox \$4.80. 91 pages.

## FINE ARTS

THE CHURCH OF NOTRE-DAME-DE-TOUTE-GRÂCE AT ASSY.

(L. C. Card No. Mic 59-3128)

William Stanley Rubin, Ph.D. Columbia University, 1959

This dissertation is a history of the modern church dedicated in 1950 at Assy in the French Alps. Interest is focussed, not on the architecture, but on the paintings, sculptures, most as and stained glass windows created by such modern masters as Bonnard, Matisse, Léger, Rouault, Lipchitz and Chagall. The style and iconography of the works are analyzed critically and then studied within the framework of the decorative program as a whole.

An evaluation of the Assy ensemble as a possible solution to the decadence of sacred art is made within the context of a study of the New Gallicanism in general and Sacred Art movement in particular. It is concluded that the radical program of Assy could not have been generated from within the ranks of Catholicism alone, but depended on a new, unorthodox, and tenuous alliance between the community of artists and a liberal minority within the church. The willingness of the famous modern artists (most of them atheists and some definitely hostile to the Catholic Church) to participate at Assy was due to a

momentary convergence of interests that normally move in different directions, producing a coalition (the liberal priests, intellectuals, artists, and Communists were joined in the Resistance) that took place only in France and that depended on a number of unusual circumstances created by World War II.

The modern masters who worked at Assy did not interest themselves in the liturgy which sacred art celebrates, and the subject matter of their works chosen by the Dominicans, particularly as it was revised to suit the participating artists, did not constitute, as is customary, an affirmation of the dogma, hierarchy, or calendar of the Church. Even the limited iconography that resulted was often handled so that its traditional meanings were altered or translated into purely personal philosophies. The decorations at Assy thus constitute neither a resumption of the centuries-old tradition of sacred art, nor a new beginning of an artistic experience that can be assimilated into the liturgy.

The Dominican promotors of Assy did not receive the support of the Church at large, and Assy came to be viewed with alarm by the Vatican which soon opened an attack upon it as a branch of its general repression of the New Gallicanism.

Microfilm \$4.65; Xerox \$15.60. 362 pages.

## FOOD TECHNOLOGY

EFFECT OF CERTAIN FIELD AND PROCESSING FACTORS ON THE TEXTURE OF BLUE LAKE GREEN BEANS.

(L. C. Card No. Mic 59-3414)

William Allen Sistrunk, Ph.D. Oregon State College, 1959

Major Professor: Robert F. Cain

Many of the difficulties encountered in maintaining high quality in processed Blue Lake pole green beans have been attributed to the newer strains. One of the most frequent complaints about the quality of canned beans has been the sloughing of the epidermal layer of cells on the bean pods.

A study was made of some of the field and processing

factors that contribute to this condition in the canned beans. The research was designed to determine the effects of a wide range of field and processing conditions on the sloughing and texture in order to explain the cause for the many variations that occur in the canned beans. These studies were carried out over a two year period and consisted of (a) the effect of field variables, (b) the effect of temperature and time of blanch, and (c) the effect of size and variety of beans on the texture of the canned beans.

Chemical and physical tests were used to measure the changes in composition and structure as a result of the treatments applied. The only chemical constituents that appeared to be related to the changes in texture and percentage of sloughed skins in the canned beans were the pectin fractions. In most instances, high correlations were obtained between the three fractions determined and

the percentage of sloughed skins. Since the percentage of sloughed skins was highly significantly correlated with firmness or softness as determined by the shear-press measurement the two physical tests for texture were in agreement.

A high incidence of sloughing and soft texture were found in canned beans that contained a high soluble pectin content and lower percentages of pectate-pectinates and alkali-soluble pectin. While other changes in composition were evident in the fresh and canned beans they were not shown to be directly related to the texture changes.

The percentage of sloughed skins and the firmness of canned beans was found to be affected by irrigation and mulch treatments, date of harvest, variety of beans, size of beans, temperature of blanch and time of blanch.

Adjustments in the blanching temperatures and times were necessary in order to fulfill the requirements of a good blanch in a given lot of beans. In general, a blanch in the temperature range of  $170^{\circ}$  to  $180^{\circ}$ F. for a time of  $1\frac{1}{2}$  to

5 minutes was adequate for blanching beans for canning. Off-flavored and squeaky beans resulted from lower temperatures and shorter times of blanch, while soft and sloughy beans resulted from higher temperatures and longer times of blanch.

From the results of the variety comparisons between the Asgrow Regular variety (old Blue Lake) and FM-1 it appears that there was not a great deal of difference between the two varieties in the texture of the canned beans. This difference was in reaction to treatment during the canning process.

The mechanical device that was developed for determining the percentage of sloughed skins of the canned beans appears to be an inexpensive and accurate method of measuring the amount of sloughed skins of the epidermal layer of cells on the bean pods. Since the percentage of sloughed skins correlated with the shear-press measurements of firmness or texture the results could be interpreted as firmness.

Microfilm \$2.10; Xerox \$7.40. 158 pages.

## GEOGRAPHY

A GEOGRAPHICAL ANALYSIS OF SEATTLE'S WHOLESALE TRADE TERRITORY.

(L. C. Card No. Mic 59-3318)

John Albert Crosby, Ph.D. University of Washington, 1959

Chairman: Edward L. Ullman

An early start plus a good situation on tidewater within a climatic region favorable for the production of a basic raw material have fostered at Seattle an economy and economic growth that have created a need for a variety of goods and services. To supply these, wholesale firms have paced the growth of the city and surrounding territory. Now, helped by historical events, which have both increased demand and provided technological advances in distributive facilities, wholesalers are located in Seattle in sufficient numbers and size so that this city has come to dominate wholesaling in the State of Washington.

The Seattle wholesale trade territory is not a homogeneous one. Topography, climate and natural resources have strongly modified the distribution of population and, thus, the character of the wholesale market in various economic regions of the state. As population has increased over the years, there have been accompanying improvements in transportation. This has permitted continued expansion of wholesale services in Seattle, where wholesaling now accounts for \$108,350,000 in payroll, or approximately nineteen per cent of that represented by manufacturing, wholesaling, retailing and service. Wholesaling also employs some 23,061 wage earners, or approximately fourteen and a half per cent of those employed in these same four categories.

As market size and accessibility have increased, so has competition from wholesalers in other cities. Seattle now competes in most lines of merchandise with the larger wholesale centers of Portland and Tacoma to the south, and with Spokane to the east. In a number of lines Seattle also faces sharp competition locally from wholesalers in the smaller centers of Bellingham and Everett to the north, Chehalis to the south, and from Wenatchee, Yakima and Walla Walla east of the Cascades.

The size and shape of the wholesale trade territory, as well as the degree of dominance held by Seattle is a reflection of the decision by hundreds of retail merchants to purchase their goods in that city rather than elsewhere. Their decisions are based upon certain facts, such as price and distance; upon certain perceptions, such as service and selection and a supposed lack of alternative sources; and upon consideration of a composite of the merchandising characteristics of a variety of product lines.

## RESEARCH PROCEDURE

In order to analyze the retail decisions responsible for the extent of Seattle's wholesale trade territory, a research procedure was organized that (1) permitted the determination of a given dominance pattern (wholesale activity) for a selected metropolitan community (Seattle), and (2) allowed an analysis of variables thought to be influential in determining this pattern.

Thus in addition to establishing an index of wholesaling, measurements were made for each of 46 towns in the Seattle hinterland on (1) distance from Seattle, (2) population size, (3) freight costs, (4) number of available alternative wholesale outlets closer than Seattle, and (5) the perceptions of retail merchants in the 46 towns relative to prices, sales pressure, and the like. These variables were then related to the index of wholesaling in a correlation analysis.

Each community in the Seattle hinterland was given an equal chance of being represented in the sample, provided

the population was greater than 1,000 and provided they had retail outlets for the product lines included in the index of wholesaling.

In the 46 selected communities, 823 retail merchants were interviewed personally with standard open-end type questions. The questioning permitted the determination of what per cent of each of 14 product lines of goods was obtained elsewhere. In addition, the interviewer probed for reasons why each retailer bought the particular amount of goods where he did.

The 14 common product lines were selected to include merchandise that was both bulky and small, heavy and light, expensive and inexpensive, franchised and non-franchised. In short, goods of varying size, worth, durability, and weight were included as follows: (1) beer and wine, (2) produce, (3) tobacco, (4) groceries, (5) auto parts, (6) metals, (7) appliances, (8) feeds, (9) paper, (10) hardware, (11) jewelry, (12) apparel, (13) furniture, and (14) drugs.

To measure wholesaling for a given hinterland town, the mean percentage of each product line purched in Seattle, by all the retailers in town who handled it, was computed. These were then averaged for a given town to obtain a composite index based upon all 14 lines of goods.

The distance of each hinterland town from Seattle was defined as the shortest road mileage between Seattle and each town. The mileage data were obtained from the Washington State Department of Highways.

By relating the composite index of wholesaling to the distance measures, a dominance gradient was determined. The next step was to relate, through a matrix of intercorrelations, this dominance gradient to nine social, phychological, and economic variables. Specific hypotheses concerning each variable were checked through the use of multiple and partial correlations. The variables were:

(1) population size, (2) wholesale outlets closer than Seattle, (3) freight cost, (4) sales pressure, (5) freedom of choice, (6) perceived distance, (7) speed of service, (8) price advantage, and (9) unawareness of alternative outlets.

#### THE RESULTS OF THE CORRELATION ANALYSIS

For the 46 communities, measures of distance and the nine other predictor variables were correlated with the dependent variable, the composite index of wholesaling, and intercorrelated with each other.

Of the nine variables, the distribution of wholesaling in the metropolitan community of Seattle was found to be significantly related to distance, existing alternative outlets closer than Seattle, sales pressure, freedom of choice, and an unawareness of alternative outlets. Freight rates were found to be indices of distance and unrelated to wholesaling when that factor is held constant. The hypothesis suggested by Bogue's findings, that population size might be significantly related to wholesaling was not supported. However, the correlation was positive and the findings do not dispute Bogue's conclusions. Further research on this relationship would have to take account of the fact that larger communities have their own wholesale outlets and are less dependent because of this. In spite of the contribution of the several variables found to be related to wholesaling when distance is controlled, there still remains considerable variation which is not accounted for. This may have been a result of the inadequacies and crudities in the present measurement techniques. In any case, further analysis is needed into the correlates of the gradient pattern of metropolitan dominance in wholesaling.

# WHOLESALE TRADE AND INTERVENING OPPORTUNITIES

In a research setting somewhat different from the present one, Stouffer advanced the well-known theory of "intervening opportunities" to account for the distribution of outward migration observed as one progresses from a given point of origin to areas at various distances. The advancement of this formulation touched off a series of studies of migration patterns which have shown the intervening opportunities concept to be useful in ordering mobility data.

While up to now, the major application of the theory has been to such migration problems, it is apparent that the original proposal was advanced as a somewhat more general conceptual scheme for relating social phenomena to distance.

The generality of Stouffer's conceptual scheme cannot be decided upon the basis of the present (or any other single) study. But, whatever direction further analysis of metropolitan dominance takes, the application of the intervening opportunities conceptual framework affords an additional approach to a possible understanding of the complex social relationships in the metropolitan community.

Microfilm \$3.40; Xerox \$11.60. 264 pages.

# GAINESVILLE, FLORIDA: A GEOGRAPHIC STUDY OF A CITY IN TRANSITION.

(L. C. Card No. Mic 59-3547)

Farhat Hussain, Ph.D. The University of Florida, 1959

This study of the historical geography of the City of Gainesville attempts to trace the pattern of the city's development, from its founding to the present, against the background of the physical and cultural setting of its site and location. It undertakes to analyze the geographic setting of Gainesville; to find out the factors that were instrumental in its settlement and growth in the perspective of historical geography; and to examine the land use and explain the urban pattern of the present.

Information on historical events and background material was accumulated from books, articles, reports, manuscripts, newspapers and letters that are in the libraries of the University of Florida. Maps and graphs were analyzed to study the following: temperature, rainfall, topography, soil, the Alachua County boundary changes, boundaries of the "Original Gainesville," platting, zoning and street pattern. Field work was done to study the present land use. Personal interviews were made with many citizens of Gainesville. The managers and owners of business and manufacturing firms were interrogated to find out the reasons for selecting Gainesville, to get information on the past and present conditions of each business or industry and, if possible, their plans for future expansion if any.

The natural conditions—climate, landforms, drainage, soils and vegetation have been described. These, together with locational relationships, form the setting within which the events of the development of the city took place. The various factors in the natural environment, which afforded resources and conditioned their use, have been analyzed and related to the economic activities basic to the growth of the city.

The study of Gainesville's historical geography was made under three periods on the basis of the factors influencing the rate of urban development. In the first period, from 1854 to 1904, the building of a railroad from Fernandina to Cedar Key was important as it was mainly responsible for the establishment of Gainesville in 1854 and for its becoming an important marketing center. In this early period cotton, corn, oranges and vegetables were grown and a limited amount of manufacturing was done. In the second period, lasting from 1905 to 1945, the establishment of the University of Florida was the most significant factor in quickening the pace of growth. The urban boundaries were enlarged; roads and streets were improved; tourists were attracted in large numbers, and business was expanded. By 1945, the city had acquired several industries and the economy had become rather well balanced. In the third period, covering the years 1946 to 1958, there was a rapid increase in population due to the influx of people to Florida and the growth of the University. Residences were constructed in large numbers, streets were improved, and the downtown area underwent significant changes. Business expanded and second ary shopping centers developed. In general, the city experienced rapid development.

Until the Zoning Ordinance of 1932, the land could be put to any use and urban development was haphazard, causing blind streets, narrow streets and mixed uses of land. Steps have been taken, particularly since 1950, to set up zones for each type of land use. The City is interested in annexing the suburbs to assure orderly development.

Through the years there have been changes in the relative importance of agriculture, mining, marketing and manufacturing. At present, education, business and industry are all making important contributions to the economy of Gainesville. Gainesville has made rapid growth since World War II and is at present the largest inland city within North Central Florida. It appears that Gainesville is destined to become the metropolis of a large area. Microfilm \$3.30; Xerox \$11.20. 253 pages.

JAPAN: SOME GEOGRAPHIC ASPECTS OF INDUSTRIALIZATION AND POPULATION CORRELATES.

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(L. C. Card No. Mic 59-3110)

Masaharu George Inaba, Ph.D. Columbia University, 1959

The industrialization of Japan during the past century has been accompanied by both chronological and geographical population correlates. In the early phase of industrialization the light consumer goods industries led by the textiles became the most important group of industries.

The heavy industries, aided by military requirements, however, were in the forefront of industrial development during the 1930s and the World War II years. Today Japan's industries present a diversified structure.

The population concurrently was going through a demographic cycle which in its major lineaments was similar to the demographic cycles which accompanied industrialization in the West. At first mortality rates dropped rapidly which resulted in a rising rate of natural population growth. Then, as urbanization became more widespread, fertility rates began to decline. The reduction of fertility rates, along with the slow down in the decline of mortality rates, has resulted in the slackening of the rate of population growth.

Because of geographic variations of physical and cultural factors, the industrialization process has proceeded at different rates in the various regions of Japan. The prefectures which industrialized rapidly attracted a net inflow of population, while the prefectures which had only minor industrial development had a net outflow of population. Six prefectures were particularly important as centers of industrial development: Tokyo, Kanagawa, Aichi, Osaka, Hyogo, and Fukuoka. They attracted large net inflows of population. Consequently these six prefectures accounted for approximately 30 percent of the total national population at mid-century.

The large scale interregional migration of population associated with industrialization has altered the geographic distribution of population. In addition, at the present time there are marked interregional variations of urban-rural, industrial employment, age and sex compositions of the population. These variations of population characteristics have direct and indirect consequences upon the different rates of regional development.

The most important region in terms of industrialization and population at mid-century is the Kanto region. Located near the center of the main island of Honshu, it is a pivotal region between the colder northern half of Japan and the warmer subtropical half of Japan. The region embraces the largest plain of Japan, the Kanto Plain, and the largest urban industrial node, the Tokyo Yokohama complex.

The Kanto region accounts for approximately one-fourth of Japan's population and manufacturing industries. Within the region one is again confronted with the close chronological and geographical relationships of population and industrial developments. Urban industrial development has been most marked in the districts in and around Tokyo and Yokohama. This area known as the Keihin Node stands apart from the remainder of the Kanto region in terms of the size and the internal composition of the population. Elsewhere, within the region, industrial and population growth has been noteworthy in the northwestern textile districts.

Because of the limited resource base, the industrial and population transformation of Japan during the past century has not produced a corresponding standard of living revolution for the masses. In comparison to the leading industrialized nations of the West, there is a unique rural urban and feudal modern dualism within the industrial and population structures. The contradictions and dualism present within the contemporary Japanese scene can be comprehended within the framework of the limited resource base and the great regional variations of the industrialization urbanization process.

Microfilm \$3.00; Xerox \$10.40. 232 pages.

TRANSPORT INPUTS AT URBAN RESIDENTIAL STARS: A STUDY IN THE TRANSPORTATION GEOGRAPHY OF URBAN AREAS.

(L. C. Card No. Mic 59-3335)

Duane Francis Marble, Ph.D. University of Washington, 1959

Chairman: Dr. William L. Garrison

The purpose of this study is to raise the level of information pertaining to the demand for movement by individual households residing within urban areas. The study concerns itself with the regular and functional interactions of the household with other parts of the city, rather than with migratory shifts in the location of the household's residential site.

Current theoretical structures and previous empirical studies are reviewed in detail and from this generally articulated structure three factors—the socio—economic structure of the household, the availability of transportation to the household, and the spatial location of the household's residential site—are isolated which are held to be of major importance in causing household—to—household variations in the level of transport inputs.

Data utilized in the empirical portion of the study consisted of detailed travel diaries for 100 sample households in Cedar Rapids, Iowa. Each member of the household ten years of age or older reported on every trip made during the two-week study period. Information on the socio-economic structure of the sample households was also collected. Techniques of large scale multiple regression analysis were utilized to examine associations between measures of transport inputs and the three factors mentioned above.

Major empirical findings of this study are:

- (1) Household-to-household variations in the total number of trips made and total time spent away from home during the study period can be largely explained on the basis of concomitant variations in the socio-economic structure of the households.
- (2) Household-to-household variations in total distance traveled during the study period cannot be explained in a satisfactory manner in terms of concomitant variation in any of the factors suggested by current theoretical constructs.
- (3) The internal structure of individual travel is much more complex than has been previously realized. The multiple-purpose trip plays a major role in the travel patterns of most persons.

These empirical findings have important theoretical implications. Existing theoretical structures are weak in many areas of application, and a major restatement of current theory appears to be necessary. The development of a powerful game-theoretic model of individual behavior in space is outlined, and suggestions for future empirical research in this direction are given.

Microfilm \$2.00; Xerox \$5.40. 107 pages.

THE CHANGING GEOGRAPHY OF THE NEW JERSEY WOODLANDS, 1600-1900.

(L. C. Card No. Mic 59-3275)

Alfred Philip Muntz, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Andrew H. Clark

One of the primary elements of the geography of eastern North America at any period has been the forests which, in varying density and composition, stretch from the tundra to the Gulf of Mexico. The characteristics and extent of these woodlands changed greatly during the processes of settlement and industrialization, and at the same time, the function of the forests as an obstacle and as a resource also changed. The purpose of this dissertation is to describe and explain such changes in the area of New Jersey during the three hundred-year period 1600 to 1900.

The study consists of three main parts, each of which considers a distinctive phase of the forest geography of the State. In part one, the characteristics of the pre-European woodlands are described, as well as the more important cultural and natural conditions which influenced their development. The second part, which involves a period beginning early in the seventeenth century and ending in 1664, is an analysis of the woodlands as an obstacle and an asset in the first attempts at settlement.

The remainder of the dissertation considers the changing woodlands from 1664 to 1900, under the impact of rapid and intensive settlement, agricultural expansion, and industrial development. This discussion is organized on a regional basis in order to emphasize the variations in forest utilization and alteration which occurred throughout New Jersey.

Analysis of several lines of evidence strongly indicates that the forests which European settlers of New Jersey encountered had been profoundly modified by the aboriginal occupants of the area. Largely because the forest was not an unbroken "primeval" wilderness, but actually contained numerous openings, the woodlands were not a serious barrier to settlement. On the other hand, the forest was a resource of the greatest importance. It provided fuel, fencing and building material in unlimited quantities, as well as a great variety of lesser products which were also important in the pioneer economy.

On the basis of pronounced differences in the way in which the woods of New Jersey were cleared and altered, and the time in which clearing occurred, as well as variations in the utilization of the forest, it has been possible to divide the State into three distinct regions. In the central region, which occupies the Kittatinny Valley, the New Jersey Piedmont and part of the Coastal Plain, agricultural settlement and permanent clearing began early in the colonial period. By the time of the Revolution the area had largely been transformed into one in which farmsteads and cleared fields were the dominant features. This was in distinct contrast to conditions in the southeastern region, where poor soils precluded widespread agricultural settlement. The forest was unquestionably the most important resource of this part of New Jersey for almost two centuries. The making of charcoal and cutting for cordwood and lumber were major industries which provided products in great demand both locally and in New York and Philadelphia. Excessive cutting and uncontrolled fires were responsible for a marked deterioration in the quality of the forests of the southeastern region, especially during the nineteenth century.

In the third forest region of the State, which occupies the hill lands of northwestern New Jersey, the forest industries were also of great importance. With the exception of parts of the unglaciated Highlands and certain valleys, clearing for agriculture was extremely limited, and most of the area remained in forest which was repeatedly cut for cordwood and charcoal. As in southeastern New Jersey, overcutting and burning were damaging, although the practice of clear-cutting coppice oak and chestnut stands at twenty- to thirty-year intervals was apparently economically sound.

Toward the end of the nineteenth century, decline in demand for many of the products of New Jersey's forests, as well as a growing interest in conservation and scientific forestry marked the beginning of a new and distinct period in the forest geography of the State.

Microfilm \$4.05; Xerox \$13.60. 313 pages.

#### GEOLOGY

GEOLOGY OF THE SOUTHERN PART OF THE TURTLE LAKE QUADRANGLE, NORTHEASTERN WASHINGTON.

(L. C. Card No. Mic 59-3313)

George Earle Becraft, Ph.D. University of Washington, 1959

Chairman: Howard A. Coombs

The Turtle Lake quadrangle is in northeastern Washington about twenty-five miles west of Spokane. The present study includes slightly more than the southern half of the quadrangle. This study is the first detailed study of the rocks in this vicinity; earlier work in the area consists of reconnaissance mapping north of the quadrangle and reports on individual mines.

The oldest rocks in the southern part of the quadrangle include impure quartzite, lime-silicate hornfels, limesilicate marble, and quartzose phyllite which form a metamorphic complex exposed in the southeastern corner of the area. The original sedimentary rocks of this complex were deposited early in the Paleozoic, probably during Cambrian time. They underwent orogeny, including lowgrade synkinematic metamorphism, during the Mesozoic -- possibly as late as Early Cretaceous. The metamorphic rocks were intruded and thermally metamorphosed by the Loon Lake granite probably about mid-Cretaceous time. In the Turtle Lake quadrangle the Loon Lake granite consists of three major units -- granodiorite, porphyritic quartz monzonite, and equigranular quartz monzonite -and includes dikes of granite perphyry, alaskite, aplite, pegmatite, and lamprophyre, which are slightly younger than the major units. After a period of considerable erosion and probably faulting along the northwest-trending Spokane-Enterprise Valley, the Oligocene (?) Gerome formation is deposited. The Gerome consists of andesitic flows and associated pyroclastic and sedimentary rocks. Many dikes of porphyritic andesite, at least some of which are feeders to the flows, were emplaced at about the same time. Faulting continued after the deposition of the pyroclastic and sedimentary rocks. Later, probably during Miocene time, the Columbia River basalt was extruded, covering much of the southern part of the area. No postbasalt faulting or folding occurred in this vicinity. During

the Pleistocene prior to the last glacial epoch, loess of the Palouse formation was deposited on the basalt and older rocks in the southern and western part of the quadrangle. Later in the Pleistocene, glaciers extended into the area from the northwest and east, but the ice did not extend onto the Columbia plateau in the quadrangle as was earlier believed. Ice-rafted boulders deposited on the Palouse and older rocks south of the Spokane River and on deeply weathered granitic rocks north of the river indicate a temporary lake occupied the river valley and drained southwestward cutting channels through the Palouse, exposing the underlying bedrock. Later, thick, stratified deposits of clay, sand, and gravel were deposited in a later lake that stood at a lower level. This later lake was probably formed by an ice-dam in the Columbia River Valley farther west. Subsequent erosion by the Spokane River has cut several terraces on these deposits.

Three uranium deposits occur in the area; two of the deposits -- Northwest Uranium and Big Smoke -- are in pyroclastic and sedimentary rocks of the Gerome formation, and one -- Lowley Lease -- is along the contact between granodiorite and older impure quartzite. The uranium ore at the Northwest Uranium mine consists of uraninite intimately associated with carbonaceous material in the lower 30 feet of a basal conglomerate. The uranium was deposited by ground water. The source of the uranium in the groundwater is not known, but possibly it was the overlying pyroclastic rocks. The uranium may have been released from these rocks during weathering.

Microfilm \$2.00; Xerox \$5.80. 120 pages.

SILIFICATION OF ARGILLACEOUS CARBONATE ROCKS.

(L. C. Card No. Mic 59-3371)

Ramon Edward Bisque, Ph.D. Iowa State College, 1959

Supervisor: Dr. John Lemish

A study was undertaken to determine and define the nature of the chemical activity which results in the growth

of "reaction shells" in certain carbonate rocks when they are used as coarse aggregate in concrete. The formation of these shells is shown to be due to stabilization of silica from some outside source, in this case the cement paste. Similar reaction shells were grown in aqueous solution under controlled conditions. It is demonstrated that only argillaceous carbonate rocks are host to this type of silicification, because the clay material functions as a site of stabilization for silica.

The nature of the rocks involved is investigated by chemical analysis, fluoride replacement studies, thin section analysis, porosity studies and X-ray examination of the clay-size fraction. In addition, reaction shell growth was studied by actual simulation and by determination of the susceptibility of various carbonate rocks to reaction with silica.

The type of chemical activity involved in the growth of these shells in concrete is shown to be deleterious to the stability of cement paste and distinct in nature from the alkali-aggregate reaction.

Speculation as to the geologic and engineering significance of the study is included in a discussion section.

Microfilm \$2.00; Xerox \$3.80. 66 pages.

HIGH-SILICA ALKALINE LAVAS OF CLARION AND SOCORRO ISLANDS, MEXICO - THEIR GENESIS AND REGIONAL SIGNIFICANCE.

(L. C. Card No. Mic 59-3242)

Wilfred Bottrill Bryan, Jr., Ph.D. The University of Wisconsin, 1959

Supervisor: Professor R. C. Emmons

Clarion and Socorro Islands are the two largest of four volcanic islands which form the Revillagigedo archipelago. They are located in the eastern Pacific ocean basin, about 300 miles west of Manzanillo, Mexico. These islands are of special geologic interest, being located on one of four major fracture zones in the eastern Pacific and structurally related to the trans-Mexico volcanic belt.

This paper presents the results of fieldwork conducted on the islands in 1955 and 1957 in conjunction with bathymetric studies of the area by research ships of the Scripps Institution of Oceanography. Geologic and topographic maps of each island have been constructed, and about 150 volcanic rocks have been examined in thin section. Nineteen new chemical analyses are presented and discussed.

The field studies have revealed evidence for a high stand of the sea at about 550 feet on both islands. This old shoreline is inferred to be of late Tertiary or early Pleistocene age and provides a datum for relative dating of volcanic activity between the two islands. A recent shoreline at about five feet above present sea level has been recognized on Clarion but not on Socorro. Probably the most recent volcanism on Socorro is younger than the five-foot stand of the sea, which is inferred to be of late Pleistocene age.

The volcanic rocks of Clarion and Socorro range in composition from basalt to trachyte and rhyolite. The lavas of Clarion Island are similar to those of Hawaii and many other islands of the Pacific Ocean basin. The lavas of Socorro Island are unusual in being predominantly siliceous, peralkaline rhyolites of a type that does not seem to have been found in any abundance elsewhere in the Pacific basin. The stratigraphic sequence of the lavas and their compositional relationships indicate that the trachytes and rhyolites were probably derived by fractional crystallization of several distinct batches of basaltic magma.

Comparisons of the Revillagigedo lavas with lavas of other oceanic islands and with rocks of some differentiated igneous intrusions suggest that "tholeiitic" basalt may have been the ultimate parent magma in the Revillagigedo Islands. It is noted that there are some significant differences in composition among the "high-silica" rocks of oceanic islands, and that there is no evidence for a structural control on the composition of volcanic rocks in the eastern Pacific. The differences between "high-silica" oceanic lavas and "high-silica" continental lavas are discussed, and it is concluded that volcanics along the socalled "andesite line" are compositionally distinct from volcanics of both the continental interiors and the ocean basins.

Microfilm \$2.35; Xerox \$8.20. 180 pages.

SEDIMENTARY HISTORY OF THE EARLY PLIOCENE IN THE LOS ANGELES BASIN, CALIFORNIA.

(L. C. Card No. Mic 59-2934)

Bert L. Conrey, Ph.D. University of Southern California, 1959

Chairman: Professor Emery

The Lower Pliocene strata in the Los Angeles Basin have an areal variation in thickness ranging from 0 to more than 5,000 feet. The strata consist principally of conglomerate, sandstone, siltstone, and silty shale. In addition, minor amounts of limestone, bentonite, chert, and volcanic ash occur among the dominant rock units. The clastic rocks display distinct areal variations in thickness, texture, and composition that provide evidence as to their depositional environments, source areas, and modes of transportation. Additional clues are provided by sedimentary structures and microfossil assemblages in the clastic rocks.

Sedimentary and faunal data indicate that the Los Angeles Basin was a submarine basin approximately 8,000 feet deep at the beginning of the Pliocene. At the close of the Early Pliocene the floor of the basin lay at approximately 6,000 feet. The broad floor of the basin was probably relatively flat; however, belts of irregular topography along the margins of the basin floor are indicated by concentrations of coarse-grained clastic rocks. Comparative studies of modern offshore basins suggest that the irregular topography represented submarine fans and slump aprons. The submarine margins of the basin are identified by (1) the position of the submarine fans and slump aprons, (2) sedimentary pinch-outs, and (3) angular unconformities. The pinch-outs and angular unconformities suggest marginal slopes of 6-10° along the eastern side of the basin and possibly 20° at its northwestern margin. A submarine sill apparently separated the deep portion of the Los Angeles Basin from the open

sea along its present coastal margin. Faunal data indicate that the deepest part of the sill was at the southwestern margin of the basin. The maximum depth of the sill probably was 6,000 feet at the beginning of the Pliocene. At the close of Early Pliocene it was approximately 4,000 feet.

The fossil faunas and sediments also provide clues as to the nature and movement of the marine waters during the Early Pliocene. The following conditions are suggested: (1) deficiency in the oxygen content of the water at the water-sediment interface on the bottom of the basin, (2) subsill waters ranging in temperature from 2.5° C. at the beginning of the Pliocene to 3.5° C. at the close of the Early Pliocene, (3) abnormally low salinity of the surface waters until Late-Early Pliocene, and (4) dominant westward and southward motion of bottom waters from the northern and eastern margins of the basin.

An average yearly depositional rate of 0.025 cm. is estimated for the Lower Pliocene strata. This rate approximates that occurring in the modern submarine basins off the coast of Southern California.

The tectonic instability of the basin floor is a contributing cause of the areal variation in thickness of strata. Moreover, localities that were undergoing active upwarping, downwarping, or faulting during the Early Pliocene are delineated by sedimentary patterns. The depth of depression of the basin and mode of deposition in the basin are typical of the Flysch stage of a normal geosynclinal cycle.

Sediments were transported into the basin in three ways: (1) turbidity currents, (2) submarine slumps, and (3) surface currents. Most of the turbidity currents and submarine slumps originated along the northern and eastern margins of the basin. The surface currents were distributed uniformly in the basin.

Seven source areas for detrital rock debris were identified in this study: (1) Santa Monica Mountains, (2) San Gabriel Mountains, (3) Puente Hills, (4) Perris Uplands, (5) Santa Ana Mountains, (6) San Joaquin Hills, and (7) Palos Verdes Hills. The principal source areas were the San Gabriel Mountains, Puente Hills, and possibly Perris Uplands. There is indisputable evidence that many of the source areas were undergoing subareal erosion. Microfilm \$4.25; Xerox \$14.40. 331 pages.

# THE GEOLOGY OF THE DUTCH MILLER GAP AREA, WASHINGTON.

(L. C. Card No. Mic 59-3320)

Ross Courtland Ellis, Ph.D. University of Washington, 1959

Chairman: Howard A. Coombs

The oldest rocks in the map area are of pre-Tertiary age and occur as two lithologically distinct and geographically separate rock units. The Easton schist occurs in the south-central portion of the map area and consists of greenschist, blue-amphibole schist, and graphitic phyllite. Rocks of the Mount Stuart block are exposed along the east margin of the map area and consist of Hawkins greenstone, Ingalls peridotite (largely serpentinized), and Mount Stuart granodiorite.

The Swauk formation, a continental sequence of more than 10,000 feet of arkose, with minor conglomerate, siltstone, and shale, was deposited in late Cretaceous and/or early Tertiary time upon the pre-Tertiary crystalline rocks. An iron rich rock locally present between the serpentinized peridotite and the Swauk formation is a laterite developed upon the ultrabasic rock in pre-Swauk time.

Before middle or late Eocene time the Swauk formation was strongly deformed along northwest trending fold axes and was deeply eroded. A few miles south of the map area the Teanaway basalt unconformably overlies the Swauk and gives evidence of this episode of deformation and erosion. The Naches formation in the south-central portion of the map area is correlative with the Teanaway basalt and consists of approximately 8,500 feet of basaltic lava flows and pyroclastic rocks with minor interbeds of arkosic sandstone.

Prior to deposition of the Keechelus volcanic formation in Oligocene (?) time, the Naches formation was strongly deformed along northwest trending fold axes; thousands of feet of uplift along a northwest trending reverse fault (Easton-Naches fault) caused erosional removal of the Naches rocks from the eastern part of the map area.

The Oligocene (?) Keechelus formation is a sequence of at least 5,000 feet of andesitic pyroclastic rocks and flow rocks. In the eastern part of the map area the Keechelus rests with angular unconformity upon an erosion surface of strong relief developed on the Swauk formation. South of the map area and west of the Easton-Naches fault, the Keechelus rests with angular unconformity upon the Naches formation. Cathedral Rock, a steep walled volcanic neck west of Hyas Lake, was probably one of the Keechelus feeders. The Mt. Garfield volcanic formation in the western portion of the map area is similar in lithology to the Keechelus formation and may be correlative.

The middle or late Tertiary quartz diorite Snoqualmie batholith is intrusive into the Easton schist, Swauk, Naches, Mt. Garfield, and Keechelus formations. A zone of high grade contact metamorphism is present adjacent to the border of the batholith.

Late Tertiary or early Quaternary uplift along a northsouth axis, transverse to the older structural trends, has formed the present Cascade Range. Pleistocene glaciation has produced distinctive glacial landforms throughout the area; the hundreds of lakes and the rugged Alpine topography are the most noticeable of the glacial features.

A volcanic ash layer a few inches in thickness commonly is present near the soil surface on gentle slopes. It is believed to have been derived from an eruption of Glacier Peak approximately 6700 years ago.

Microfilm \$2.00; Xerox \$6.20. 127 pages.

# STRATIGRAPHY, STRUCTURE AND COMPOSITION OF CEMENT MATERIALS IN NORTH CENTRAL CALIFORNIA.

(L. C. Card No. Mic 59-3086)

John Nicholas Faick, Ph.D. University of Arizona, 1959

Supervisor: W. C. Lacy

A geologic investigation was made in north central California for materials from which to manufacture cement.

Parts of the Sierra Nevada and Great Valley provinces are included in the area investigated. The area is underlain by sedimentary and igneous rocks ranging in age from Silurian to Recent. Paleozoic shales, sandstones, limestones, and associated igneous rocks were metamorphosed, tightly folded, uplifted and eroded at the close of the Paleozoic. These were again submerged in the Mesozoic when a nearly similar sequence of rocks was formed. The rocks of these two eras are grouped together as the "Bedrock series" although they are separated by a profound unconformity. Uplift during the Sierra Nevada orogeny and subsequent erosion caused great amounts of material to be removed from the Sierra Nevada and deposited as clastic sediments in the Great Valley province during the Cretaceous and Cenozoic. Many deposits of calcareous materials are present in formations of Carboniferous and Triassic age. In Plumas County two large deposits of Triassic age were mapped, drilled, and sampled. The deposit near Genesee is the type locality for the Hosselkus limestone. This large, relatively pure deposit is deformed, having been overturned, folded, and faulted. Near Virgilia is a deposit of argillaceous limestone having a composition similar to natural cement rock. Argillaceous materials suitable for cement admixture occur in some of the Carboniferous formations and in post-Jurassic rocks along the east side of the Sacramento Valley. Some Upper Cenozoic rhyolitic tuffs occurring in the area have pozzolanic properties.

Microfilm \$2.30; Xerox \$8.00. 173 pages.

GEOLOGY AND PETROLOGY OF THE GLACIER PEAK QUADRANGLE, NORTHERN CASCADES, WASHINGTON.

(L. C. Card No. Mic 59-3322)

Arthur Barnes Ford, Ph.D. University of Washington, 1959

Chairman: Peter Misch

A highly varied assemblage of metamorphic rocks, as well as fully magmatic intrusive granitic rocks underlie the probably Pleistocene andesites of Glacier Peak. The main types of isochemical metamorphic rocks are biotitic schists, many kyanite and staurolite bearing; hornblendic schists and garbenschiefer; and amphibolites. The main types of highly feldspathized metamorphic rocks are homogeneous quartz dioritic and trondhjemitic gneisses and nearly directionless quartz diorites and trondhjemites. Highly heterogeneous migmatites are locally abundant. These rocks belong to the crystalline core of the Northern Cascades. Presumably their metamorphism occurred prior to middle or late Jurassic.

The metamorphic rocks were formed mainly in the medium-grade zone of progressive, synkinematic regional metamorphism. Most biotitic and hornblendic schists and amphibolites are characterized by crystallization schistosity free of postcrystalline deformation. More locally, postkinematic recrystallization of hornblendic rocks produced typical hornblende garbenschiefer.

Allochemical metamorphism involving introduction of mostly sodium and silica, and more locally of potassium,

apparently occurred chiefly under late-kinematic and postkinematic medium-grade conditions; it resulted in the production of various types of migmatites, of quartz dioritic and trondhjemitic gneisses, and of weakly gneissose and directionless granitic rocks. Incipient and local mobilization of a few highly feldspathized and statically recrystallized rocks is suggested by late, general cataclasis superimposed upon earlier crystalloblastic textures.

The highly feldspathized rocks are derived mostly from hornblendic rocks, probably amphibolites. In general, they overlie the lowermost thick unit of mainly isochemical rocks. The lowermost rocks belong to a thick series of predominantly biotitic schists, many containing staurolite and kyanite, that are derived from original argillaceous rocks.

The metamorphic rocks occur in a series of broad and open anticlinoria and synclinoria. Minor folds are commonly isoclinal. Most folds display mobile, flowage patterns. Superimposed upon these structures are later, mostly high-angle strike faults.

Intrusive into the highly metamorphic rocks are several bodies of igneous granitic and basic rocks. The largest, possibly an intrusion of small-batholithic size, is in the area of Miners Ridge. Many of the Miners Ridge quartz diorites were greatly affected by probably deuteric processes that resulted in the development of crystalloblastic textures of the quartz and late feldspars, and of a more nearly granitic composition. The crystalloblastic textures are clearly superimposed upon earlier igneous features. Possibly, much of this intrusive igneous activity occurred during later Mesozoic or earlier Tertiary time.

Following a long period of erosion which produced topography of moderate to high relief, the extrusion of predominantly hypersthene-bearing andesitic lavas resulted in the building of the volcanic cone of Glacier Peak. Many of the Glacier Peak andesites have been deeply eroded by valley and cirque glaciers; thus they presumably are at least as old as earlier Pleistocene. At least one flow, however, apparently is postglacial. Few pyroclastic rocks were associated with the earlier eruptions. In contrast, postglacial eruptions were characterized by pyroclastic materials. Thick deposits of mostly unconsolidated pyroclastic rocks partly fill deep, glacierscoured valleys adjacent to the volcano.

Little or no differentiation occurred during the period of activity of the volcano. Nearly all the Glacier Peak rocks are andesitic in composition, but many are classed as "basaltic andesites". Hypersthene is the most abundant and ubiquitous mafic mineral. Augite, hornblende, and olivine are less common and biotite is rare.

The final phase of igneous activity was the eruption of olivine basaltic pyroclastic materials from two vents several miles south of Glacier Peak. One vent, a well-shaped cinder cone, occurs in a small cirque and is definitely postglacial. Warm springs are present at two places near Glacier Peak. There is little evidence of present-day activity in the crater area of Glacier Peak.

Microfilm \$4.80; Xerox \$16.00. 374 pages.

OCCURRENCE MINERALOGY AND ORIGIN OF THE LOWER GOLDEN VALLEY KAOLINITIC CLAY DEPOSITS NEAR DICKINSON NORTH DAKOTA,

(L. C. Card No. Mic 59-3187)

Donald Hayes Freas, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Eugene N. Cameron

This thesis describes a detailed field and laboratory investigation of the occurrence and mineralogy of the kaolinitic clay deposits of the lower part of the Eocene Golden Valley formation near Dickinson, North Dakota. The data presented shed light on the origin and mode of formation of the clay deposits.

The clay deposits were described, mapped, and sampled. Clay minerals were studied by x-ray methods supplemented by various cation-saturation and heat treatments. A method of x-ray quantitative analysis was developed. Thin sections of the clays and enclosing sediments were also studied. Heavy minerals were separated

and quantitatively determined.

The general geology and Tertiary geologic history of the area are outlined. The Lower Golden Valley clay deposits are defined as the light gray clay and associated silts and sands lying immediately above the brown sands and silts of the Fort Union formation and underlying the upper member of the Golden Valley formation. The clay deposits are described in detail and a general stratigraphic succession of lithologies within the deposits is noted. Sand occurs in the lower part of the deposit, clay in the middle, and silt in the upper part. Overlying the clay deposits is a thin lignite zone consisting of silty carbonaceous clay and lignite. Limonite concretions, which originally were pyrite, occur profusely in the deposits.

Poorly crystallized kaolinite is the dominant clay mineral; illite (2M polymorph) and montmorillonite are common. Halloysite and mixed-layer illite-montmorillonite are minor constituents. Chlorite occurs in the enclosing sediments. Most of the montmorillonite and probably the mixed-layer minerals were derived from muscovite. The clay mineral content of the deposits is nearly constant within the area studied. A significant stratigraphic variation in clay mineral proportions, however, is found. Kaolinite increases upward within the deposits, as does montmorillonite, but the illite content decreases. The clay deposits contain a much more stable mineral assemblage than do the associated sediments. In general, the varieties of heavy minerals in the deposits are the same as those in the enclosing sediments, but the proportions vary considerably.

Weathering of pre-existing sediments in place is unacceptable as an explanation of the origin of the clay deposits. Textural and stratigraphic evidence also oppose origin of the kaolinite by authigenic or diagenic processes. A detrital theory of origin is proposed instead. Weathering of Paleocene-Eocene sediments in the east-central Montana region during a time of tectonic stability and a humid, sub-tropical climate produced kaolinitic soils. The kaolinite was then transported by streams to a large lake basin which lay to the east in North Dakota. The lithologic succession within the clay deposits can be explained by lacustrine sedimentation. Stratigraphic vari-

ations in proportions of minerals within the deposits suggest that weathering achieved maximum intensity just prior to the filling of the basin.

Microfilm \$2.00; Xerox \$4.40. 83 pages.

# STRATIGRAPHIC ANALYSIS OF THE MISSISSIPPIAN MISSION CANYON FORMATION, WILLISTON BASIN.

(L. C. Card No. Mic 59-3298)

Alan Ray Hansen, Ph.D. University of Utah, 1959

Chairman: William Lee Stokes

The Williston Basin existed throughout Paleozoic time as an intracratonic basin, marginal to the Canadian Shield and Transcontinental Arch. During the Mesozoic and Cenozoic Eras the basin continued to subside, but was divided into several smaller basins and platforms.

Paleozoic sediments record several widespread unconformities, and many cyclic recurrences of evaporitic and open marine environments. The evaporite deposits were controlled by reef growth, calcarenite accumulations and structural uplifts that developed on or near marginal shelf areas, forming barriers and impounding the marine waters.

Isopach and lithofacies studies of Mississippian strata show that an evaporite basin occupied central North Dakota during Mission Canyon (Osagian Mississippian) time. Structural uplifts within the basin and incipient reef growth on the marginal shelf areas served to restrict the marine waters from which the evaporites were deposited. Detailed investigations of the Mission Canyon reef complexes show an abrupt transition from evaporites (halite and anhydrite) on one side of the reef barriers to normal marine carbonates (limestone and dolomite) on the other.

The Mission Canyon sedimentary rocks produce major quantities of oil in the Williston Basin. Much of the oil has accumulated in areas of abrupt facies changes between the evaporitic and open marine environments.

Microfilm \$2.00; Xerox \$4.80. 95 pages.

# PRECAMBRIAN GEOLOGY OF THE LEDGE LAKE AREA, MANITOBA AND SASKATCHEWAN, CANADA.

(L. C. Card No. Mic 59-3327)

William Walter Heywood, Ph.D. University of Washington, 1959

Chairman: Peter Misch

Volcanic and sedimentary rocks of the Amisk and Missi Groups in the Ledge Lake area, near Flin Flon, Manitoba, are a part of a thick Precambrian sequence. The Amisk Group is predominantly composed of andesitic and basaltic flow and pyroclastic rocks having an exposed thickness of about 17,000 feet. Diabase dykes and sills

are probably genetically related to the Amisk volcanic rocks. Sedimentary rocks of the Missi Group unconformably overlie the Amisk volcanic rocks in adjacent areas, but these rocks are in fault contact in the Ledge Lake area.

Plutonic rocks, ranging from diorite to granodiorite, have intruded the Amisk volcanic rocks and the related diabasic dykes and sills. The Ledge Lake quartz diorite and the Hook Lake diorite and quartz diorite, form sill-like intrusions that are probably pre-metamorphic, and by implication, pre-tectonic. Intense folding of the Amisk volcanic rocks and the Missi sedimentary rocks was accompanied by the intrusion of the Kaminis granodiorite. The syn- or post-tectonic Phantom granodiorite is probably related to the Kaminis granodiorite.

Low-grade regional metamorphism of the andesitic and basaltic flow and pyroclastic rocks, and of the diabasic rocks has resulted in the development of greenschist, greenstone, and metadiabase, characterized by the presence of albite or oligoclase, chlorite, actinolite, and epidote. The thermal metamorphic aureole, averaging about 3,500 feet wide around the Kaminis granodiorite, is divided into the transition, medium, and high grade zones. The transition zone, occurring between the low-grade regional metamorphic zone and the medium-grade thermal metamorphic zone, contains minerals characteristic of both zones. It represents a narrow interval in which minerals of the greenschist facies, and the 'epidote albite-amphibolite' facies are stable associates. The medium-grade zone is characterized by oligoclase or andesine, epidote, actinolitic hornblende, and hornblende. The actinolitic hornblende is restricted to the lowest part of the zone. The high-grade zone is developed only locally; it is characterized by the occurrence of pyroxene, hornblende, and andesite or labradorite.

Microfilm \$2.40; Xerox \$8.40. 181 pages.

GEOLOGY OF BOSSIER PARISH, LOUISIANA.

(L. C. Card No. Mic 59-3077)

Douglas Epps Jones, Ph.D. Louisiana State University, 1959

Supervisor: Professor Clarence O. Durham, Jr.

Geological investigations in Bossier Parish, Louisiana, disclose exposures ranging in age from lower Eocene Wilcox to middle Eocene Cook Mountain. Subsurface data indicate that the Sabine uplift, on the northeast flank of which Bossier Parish is situated, is complicated by several local structures in this area.

This investigation has produced the first detailed surface geological map of Bossier Parish. The Wilcox group of lower Eccene age is represented by 300 to 550 feet of sediments which are undifferentiated except for the uppermost sand unit, the Carrizo formation.

In Bossier Parish the interval between the top of the Wilcox group and the base of the Claiborne Sparta formation is undifferentiated throughout most of the parish. The sediments of this interval, 220 to 300 feet of glauconitic sand and clay, are mapped in central and southeast Bossier Parish as "undifferentiated lower Claiborne". In northwest Bossier Parish, adjacent to the Red River, this inter-

val is divided into three formations which have been correlated by electrical logs with the Reklaw, Queen City and Weches formations of East Texas. Overlying these units are the Sparta formation, 220 to 350 feet of sand and interbedded sand and clay; and the Cook Mountain formation, 250 feet of glauconitic clay, sand and ironstone. These formations crop out in a general northwest-southeast belt across the parish and dip northeast at a rate from 15 to 60 feet per mile.

Two Pleistocene formations have been mapped in Bossier Parish and a third formation possibly is present. The youngest formation, the Prairie, is the only one to which a formal name has been applied; the other deposits are mapped as "undifferentiated terrace deposits". The Prairie surface extends over a large portion of Bossier Parish and tends to surround the Tertiary highlands. This surface is found to be 10 to 16 feet lower along tributary streams than the level along trunk streams. The same relationship is found in some of the recent alluvial deposits and is considered a possible explanation for the formation of Lake Bodcau during the last century. The topographically higher, older Pleistocene deposits are difficult to map due to lithologic similarities to the Tertiary blanket sands.

The Bellevue dome in east central Bossier Parish and the Sligo dome in south central Bossier Parish represent deformation which occurred along the edge of the Sabine uplift during the Tertiary. The Bellevue dome, which has undergone some 1,500 feet of vertical uplift, is indicated by the presence of Wilcox sediments as an inlier within the Claiborne outcrop. This structure lies along the northeast extremity of the Sabine uplift and is complicated by numerous faults.

The Sligo dome is situated on the Sabine uplift and has not experienced the degree of deformation undergone by the Bellevue dome. The structure is not as apparent as the Bellevue dome but is indicated by eastward dips on the base of the Carrizo formation in excess of the normal amount which is 30 to 40 feet per mile northeast.

In T22N, R14W, in the Gilmer Hill community of Bossier Parish, a series of northwest-southeast and northeast-southwest normal faults have been mapped. These faults have displacements ranging from about 10 feet to approximately 40 feet and may have resulted from a basement flexure in this area where subsurface contours indicate a change of strike of the Upper Cretaceous Annona formation from northwest to a more westerly direction.

This investigation was conducted under the auspices of the Louisiana Geological Survey.

Microfilm \$2.00; Xerox \$6.80. 141 pages.

# GEOLOGY OF THE FINNEY PEAK AREA, NORTHERN CASCADES OF WASHINGTON.

(L. C. Card No. Mic 59-3328)

Robert William Jones, Ph.D. University of Washington, 1959

Chairman: Peter Misch

The Finney Peak area is on the western slope of the Northern Cascades, about 60 miles north-northeast of Seattle.

The northeastern part of the map area is underlain by the Carboniferous (?) Sutter Mountain unit, consisting of unmetamorphosed sedimentary and intermediate to basic volcanic rocks. These rocks are the lower plate of the Shuksan-Whitechuck overthrust which is just east of the map area and in which the Shuksan greenschists and associated phyllites east of the Sauk River are the upper plate. To the southwest, the Sutter Mountain unit is in high angle fault contact with the Gold Mountain phyllite.

Much of the eastern part of the map area is underlain by a broad belt of Gold Mountain phyllite which is flanked on the west by a narrower belt of Finney greenschist, consisting of actinolite-, tremolite-, glaucophane-, and crossite schists with interlayered quartz-albite schists. The greenschists and phyllites were metamorphosed together in a subfacies of the glaucophane schist facies, probably during a post-Paleozoic, pre-Upper Jurrassic orogeny. The metamorphism was isochemical except for late soda metasomatism of the quartz-albite schists. These metamorphic rocks are isoclinally folded along northwesterly trends. The Finney greenschist forms the core of a synclinorium; the Gold Mountain phyllite, the adjacent anticlinorium. To the west these rocks are in part in unconformable contact, and in part in tectonic contact, with younger rocks, principally the Swauk forma-

The Swauk formation consists of at least 8000 feet of continental arkoses and siltstones. A leaf collection from the present area is assigned to the Eocene. The presumed upper portion of the unit yielded in a variety of small folds, in contrast to the yielding, under the same forces, into a few, large, simple folds which is exhibited by the lower portion. To the east, the Swauk formation unconformably overlies the low grade metamorphic rocks or an intervening, thin sequence of unmetamorphosed volcanic rocks. To the west, the Swauk formation probably is in high angle fault contact with older volcanic rocks. The Swauk formation is unconformably overlain by at least 1000 feet of volcanic rocks, principally dacites. North of Round Mountain, a block of the Swauk formation and the overlying volcanic rocks has been faulted down relative to the Finney greenschist and perhaps also relative to parts of the Swauk formation.

Scattered, small exposures of medium grade, hornblendic gneisses and schists are tectonic splinters which either were dragged along by the Shuksan-Whitechuck overthrust or else were brought up by high angle faulting.

Although direct evidence is lacking, the Shuksan-White-chuck overthrust may pass beneath the map area. If the overthrust is present, the Finney greenschist and Gold Mountain phyllite would be the upper plate, and the Sutter Mountain unit would be the lower plate, faulted up in the northeastern part of the area. The resemblance of the medium grade metamorphic rocks to rocks found elsewhere as tectonic splinters in the Shuksan-Whitechuck overthrust suggests that the overthrust may be present.

If the overthrust is not present, the Sutter Mountain unit most probably unconformably overlies, and is faulted down into, the phyllites and greenschists. In this case, the age of metamorphism would probably be pre-late Paleozoic.

High angle faulting has affected both Tertiary and pre-Tertiary rocks. These faults exhibit an irregular block pattern.

During the Pleistocene, continental glaciers overrode the area and reached elevations of at least 4000 feet. Ice marginal drainage crossed the area in progressively lower channels from east to west.

Microfilm \$2.70; Xerox \$9.20. 205 pages.

FUSULINIDS OF THE TYPE MARBLE FALLS LIMESTONE OF TEXAS (LOWER PENNSYLVANIAN).

(L. C. Card No. Mic 59-3201)

William Edward King, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Lewis M. Cline

Thin sections of limestone samples from a series of 77 collections of the type Marble Falls limestone reveal a large population of primitive fusulinid genera. More than 900 individual fusulinid specimens were studied in the preparation of this paper. A total of 23 species are described. Millerella fallsensis, M. moodyi, M. upsoni, M. cheneyi, M. minuta, M. texana, M. sandersoni, Paramillerella plummeri and P. moorei are new species.

Many individual species are sufficiently distinctive in their morphology to be readily distinguishable and appear to be restricted to narrow stratigraphic ranges within the type Marble Falls. However, assemblages of these fusulinids are more easily recognized and, therefore, more suitable for correlation than individuals. The assemblage of Millerella texana, M. inflecta and Paramillerella advena is confined to the lower part of the type Marble Falls limestone. Millerella sandersoni, M. cheneyi, M. minuta, M. upsoni, Paramillerella moorei and Nankinella plummeri are found only in the upper one-half of the Marble Falls. The genera Nankinella and Staffella occur only in the upper two-thirds of the stratigraphic unit.

Profusulinella marblensis, a distinctive and easily recognized species, is confined to the upper one-third of the type Marble Falls.

Fusulinids confirm the fact that the age of the type Marble Falls is Morrowan and Atokan. Detailed collecting and thin sectioning discloses only primitive genera, like those of the type Morrowan, in the lower two-thirds of the stratigraphic unit. The presence of Profusulinella marblensis in the upper one-third of the limestone is thought to indicate an Atokan age for this portion.

Microfilm \$2.00; Xerox \$6.40. 134 pages.

THE APPLICATION OF THE PHOTOMETER METHOD IN DETERMINING THE CRYSTALLOGRAPHIC FABRIC OF QUARTZ IN METAMORPHIC QUARTZITES.

(L. C. Card No. Mic 59-3080)

Joseph Didier Martinez, Ph.D. Louisiana State University, 1959

Supervisor: Professor Adolph E. Sandberg

A new photometric technique recently applied to an essentially two-dimensional fabric study of quartose

sandstones has been tested in a three-dimensional fabric analysis of metamorphic quartzites.

The technique thus far introduced into the literature consists of "measuring by means of an attached photometer the variation in the intensity of monochromatic light passed through a standard thin section of sandstone on the stage of a petrographic microscope with gypsum plate inserted and nicols crossed during a 360° rotation of the stage. Minimum intensity of light occurs when the trend of the optic axes of the quartz grains lies parallel with the slow direction of vibration of light in the gypsum plate."

The extension of this technique, proposed and tested in this thesis, is that the direction in space of the preferred optic axis orientation of quartz in a metamorphic quartzite may be determined by examining photometrically three mutually perpendicular thin sections. The trend of c-axes thus determined in each section is in reality the trace of a plane which contains this trend. If the orientation is dominantly linear, then the three planes have a mutual line of intersection which is the trend of the preferred optic axis orientation with reference to a three-dimensional system of axes. These reference axes are initially selected parallel with the edges of the three mutually perpendicular thin sections. If the orientation is dominantly planar, there is no common line of intersection. One of the traces determined will establish the "strike" of this planar unit. The other two, which are "apparent dips," will establish its "true dip." This "strike" and "dip" will be with reference to the system of axes initially chosen parallel with the edges of the three mutually perpendicular thin sections. While these two limiting cases are considered susceptible of analysis, it is recognized that a fabric characterized by a point maximum in a girdle or a more complicated fabric could not be exactly determined.

The Phantom Canyon quartzite of Algonkian age from the vicinity of Canon City, Colorado, has been studied in some detail by this method. Pre-Cambrian quartzites of the Picuris Range in New Mexico have also been studied. One sample from the Uncompander quartzite near Ouray, Colorado, has been examined.

With the possible exception of the last mentioned sample, all of the samples examined showed evidence of a dominantly linear orientation. The results obtained demonstrated the validity of the proposed technique.

The origin of the preferred orientation in the Phantom Canyon quartzite cannot be explained by the various hypotheses based upon direct componental movement, unless two separate and differently oriented deformations are assumed. They might be explained by a post-tectonic crystallization.

The preferred orientation in the Vadito quartzite of the Picuris Range is similar to a preferred orientation, the origin of which, has been explained by one of the hypotheses based on direct componental movement. However, certain difficulties do arise in applying this hypothesis. Some structural evidence was obtained from this analysis that is useful for differentiating between deformational and non-deformational features.

Microfilm \$2.00; Xerox \$6.20. 126 pages.

PENNSYLVANIAN FORAMINIFERA FROM THE BIG SALINE FORMATION OF THE LLANO UPLIFT OF TEXAS.

(L. C. Card No. Mic 59-3273)

Walter Leroy Moore, Ph.D. The University of Wisconsin, 1959

Supervisor: Assistant Professor Roger Batten

A previously unstudied and unusually well preserved fauna of lower Pennsylvanian foraminifers is present in the lower portion of the Big Saline formation, below Richards' Ranch Crossing of Onion Creek, on the west side of the Llano Uplift, McCullock County, Texas.

The fauna is small, consisting of eight genera of which one <u>Upsonella</u> is new and eight species of which two, <u>Upsonella</u> typus and Orthovertella elongata, are new.

The new genus Upsonella is a unilocular, subspherical, spinose foraminifer characterized by a distinctive furrow or attachment scar which is developed along the base of the test and which has a narrow flap or rim around its periphery. The multiple apertures of this form are probably associated with the spines.

Endothyra? rotaliformis Warthin, 1930 is present in fauna in small numbers as is a species of Endothyranella Galloway and Harlton, 1930.

Climacammina magna Roth and Skinner, 1930 displays two distinct population groups which are identical except for differences in size. The populations do not intergrade and are the probable result of dimorphism. Assignment of either group to the microspheric or megalospheric generation is problematic but the larger of the two forms present is tentatively considered the microspheric form

because of its larger size. In the fauna it can be demonstrated that the primary wall of Millerella marblensis Thompson, 1942 consists of both tectum and diaphanotheca and not tectum alone as had previously been described. This species further displays a variably developed trough like indentation at the base of the last septa which resembles an apertural opening and which is here defined as the apertural groove. Associated with the apertural groove, in a few specimens, are openings of the dimensions of septal pores which may represent an aperture. The position of the genus Millerella Thompson, 1942 within the family Fusulinidae is discussed and it is concluded that the essential characteristics of this family, in the form of tunnel formation by resorption and deposition of secondary deposits as chomata and epitheca, are present and Millerella should not be excluded from the family on the basis of its small size and low form ratio.

In Pseudostaffella sp. multiple juvenaria and an immature specimen enclosed within the test of an adult permit some comment on the possible similarity of the reproductive processes of recent and ancient foraminifera.

Orthovertella elongata n. sp. displays a great range of specific variability based on the interplay between the amount of coiling of the early part of the test and the tube diameter. Specimens with small tube diameters and little coiling of the test are distinct from those with a large diameter tube and a heavily coiled initial part but all gradations between the two types are present in the collection.

Globivalvulina biserialis Cushman and Waters, 1928 is shown by thin section studies to be coiled biserial and not trochoid. The oral pit, oral groove and coiling cavity are defined for this species and the occurrence of cavity filling within the early part of the coiling cavity is noted.

The fauna is of Pennsylvanian aspect but lacks clearly

definitive age index species.

Microfilm \$2.40; Xerox \$8.40. 184 pages.

RECENT SEDIMENTS OF THE NORTHEAST PACIFIC.

(L. C. Card No. Mic 59-3338)

Y. Rammohanroy Nayudu, Ph.D. University of Washington, 1959

Chairman: Julian D. Barksdale

This study is based on 150 slope and deep-sea sediment cores from the Northeast Pacific, an area previously treated by Menard and Dietz, who established the general character of submarine relief and sediment distribution. It is possible to delineate within the area the following seven well-defined sedimentary types based on the upper 5 to 10 cm core interval: (1) terrigenous deposits of pebble to clay; (2) terrigenous sediments of fine sand to clay with diatoms common but less than 20 percent; (3) diatom-rich sediments (diatoms over 20 percent by volume) of fine sand to clay; (4) clay with Radiolaria; (5) Globigerina-rich silts and clays; (6) glacial marine remnants with diatoms; (7) Katmai volcanic ash. In addition, the following units were penetrated at depth and do not appear in the surface layer: (1) glacial marine remnants without diatoms; (2) brown volcanic ash; (3) biologically barren silts and clays; (4) Foraminifera-rich silts of the northern region. Stratigraphy and correlation of these units is discussed.

Diatomaceous sediments are more extensive than previously shown. During the Pleistocene time, the limit of diatom-rich sediments was probably at its present position. Since the Pleistocene, the increased supply of rock flour and other terrigenous sediments has diluted the more northerly diatom-rich sediments producing a type consisting of less than 20 percent diatoms by volume. The more southerly diatom-rich area has been relatively undiluted, resulting in a type containing more than 20 percent diatoms and glacial marine remnants with diatoms. The sediment distribution pattern conforms to the present surface current pattern.

South of the diatomaceous sediments is a distinct sedimentary province of clays rich in Radiolaria. A few diatoms occur at the transitional boundaries. Few arenaceous Foraminifera are present. Sand-silt layers occur in this unit. Composition of these sand layers suggest continental origin although the site is 600 miles from the nearest land at a depth of 2500 fathoms.

East of the Radiolarian clays is a narrow band of Globigerina-rich silts and clays almost paralleling the Washington and Oregon coasts 300 miles to the east

Three distinct ash layers are shown in the cores from

the northern region. A top acidic layer which covers the terrigenous sediments is considered to be from the Katmai volcanic eruption of 1912. The distribution of this ash is more widespread than previously supposed, approximately 400 miles from source. Basic volcanic ash with glass of basaltic composition is observed at depth in some cores of the northern region. The source of this ash is unknown. A third layer of acidic volcanic ash, which is older than 25,000 years is recorded in two cores.

Radiocarbon dating of five samples reveals that the sediments penetrated by the cores were deposited during the Late Pleistocene to Recent times. It is inferred that prior to 25,000 years ago, relatively warmer conditions existed, resulting in the Foraminifera-rich sediments of the northern region found at depth only. This unit is similar to Bramlette and Bradley's "sediment intermediate between glacial marine and foraminiferal marl" in the North Atlantic. The non-glacial interval between Glacial Substage III and IV and a part of Substage IV of Hough is the likely time interval involved.

The deposition rate for the diatom-rich sediments of the north is considered to be 1 cm per 1000 years.

The depositional history of the Globigerina-rich silts and clays of the southern region involves the period from 12,000 to 20,000 years ago. During the past 12,000 years, silts and clays with Radiolaria were deposited with an average rate of sedimentation of 2 cm per 1000 years. Radiocarbon dating indicated that the sedimentation rate of the Globigerina-rich silts and clays has appreciably slowed resulting in the surface band which is essentially a relict. Microfilm \$3.00; Xerox \$10.20. 229 pages.

THE STRATIGRAPHY AND STRUCTURE
OF THE NORTHERNMOST PART OF
THE NORTHERN SNAKE RANGE AND THE
KERN MOUNTAINS IN EASTERN NEVADA
AND THE SOUTHERN DEEP CREEK RANGE
IN WESTERN UTAH.

(L. C. Card No. Mic 59-3339)

Robert Benjamin Nelson, Ph.D. University of Washington, 1959

Chairman: Peter Misch

This area is in a north-south trending mountainous belt which lies along the Utah and Nevada border near the middle of the Great Basin. It includes a northernmost part of the Snake Range and the Kern Mountains in eastern Nevada, and the southern Deep Creek Range in western Utah. This paper deals principally with the pre-Mesozoic stratigraphic section in this, a central segment of the avolcanic eastern portion of the Cordilleran geosyncline, and the orogenic features which were developed from these rocks during the Late Mesozoic and possibly even also the earliest Tertiary.

The stratigraphic section includes:

Time	Formation	Thickness in feet
Middle or Late	Manager Street, Street, Street, Str. Ast.	124.171 2471
Tertiary	Grey Conglomerate UNCONFORMITY?	300+
Latest Mesozoic or	'(Fresh-water limestone	
Early (?) Tertiary	(and siltstone unit	400+
	(Variegated volcanic unit ( UNCONFORMITY	500-2000
	(Breccia and sandstone unit UNCONFORMITY	0-200
Lower Permian	Arcturus formation DISCONFORMITY	5000-6000
Lower and		
Middle?Penn.	Ely formation	2000+
Upper Mississippian		1500+
	(Joana limestone	160-200
Lower		
Mississippian	(Pilot shale	540 ±
Upper Devonian	(Guilmette formation	1400+
	(Simonson dolomite	1050+
Middle Devonian	(Sevy dolomite	500-600
	DISCONFORMITY	
Silurian	Laketown? dolomite	850 ±
Upper Ordovician	Ely Springs dolomite DISCONFORMITY	250 <u>+</u>
Middle Ordovician	(Eureka quartzite	150-320
Lower Ordovician	(Pogonip group	2700+
	(Limestone and Chert Unit	600-800
Upper Cambrian	(Greenish-grey shale (Limestone and	50-200
	Dolomite unit	2000+
	(Young Peak dolomite	200+
Middle Cambrian	(Abecrombie formation	2700+
	(Busby quartzite	500+
Lower Cambrian	(Pioche (cabin) shale (Prospect Mountain	500±
	quartzite	2500+
Latest	and the state of the section of the	
Precambrian	(Quartzite and argillite unit DECOLLEMENT THRUS	
	(Light-grey metaquartzite (Cherry Canyon unit	1500+
	(schists)	3000+
Late Precambrian	(Trout Creek unif (schists)	2900+
(Medium-grade	(Tectonitic, dolomitic	
metasediments)	marble	0-500
	(Schist and amphibolite	E00 .
	unit (Schists and quartzites, undifferentiated	500+

Prior to the onset of the intense orogeny, and later than the probably Jurassic non-marine sedimentation, a broad warping of these geosynclinal sediments seems to have occurred. The features apparently thus developed were beveled by erosion.

The main orogeny in this part of the Great Basin is marked by large-scale thrust masses moving toward the southeast which have pushed the thick sedimentary cover over the underlying metamorphic basement complex (Misch, 1957). In the present area, the décollement plane between these is well exposed. Its lower and upper plates have had a different structural response. The lower plate

has locally been intensely deformed, and many thousands of feet of the metasedimentary section apparently been tectonically removed during the thrusting. This was accompanied by a mineralogical retrogression of those metasediments near the thrust plane. Parallel to this décollement plane, a sheet of schistose, mylonitic marble was developed that is discordant to both the rocks below and above. In a later stage of the orogeny this marble was plastically folded; this may have been combined with some secondary redistribution perhaps due to inceptive upwarping of the décollement plane. Small stringers of granitic magma were intruded into the marble during this period. The upper plate of the décollement thrust contains a number of characteristic deformational patterns which include imbricate slicing, thrusting, tear faulting and the development of an east-northeasterly trending, large-scale transverse fold.

After the main orogeny, and after a subsequent period of erosion, a thick sequence of probably Early Tertiary sediments and "ignimbrites" were deposited. Minor deformation accompanied the deposition of the basal portion of the volcanic part of this series. The series was then turned nearly on end, although this was possibly accomplished by the emplacement of Tertiary large quartz-monzonitic masses, two of which are at present exposed in the region mapped; these are at the center of the Kern Mountains and Deep Creek Range, and are aligned parallel north-northeasterly structural trend. They are both bordered on the north by faults that are perpendicular to this trend.

Between the Kern Mountains and the southern Deep Creek Range, is a triangularly-shaped graben that widens eastward. The fault that forms the southern boundary of this graben and the northern boundary of the Kern Mountain intrusive mass extends eastward from Antelope Valley into the head of Pleasant Valley, where it bifurcates to form both the bordering faults of the graben. This graben contains some of the latest Mesozoic or Early Tertiary rocks previously mentioned.

In the southwestern part of the Deep Creek Range are a number of north-south trending, high-angle faults that cut through the orogenic structures; these faults are considered Tertiary, but apparently have little to do with the present high relief, and may be related to the emplacement of the intrusion in the Deep Creek Range.

A normal (basin-range) fault appears to be present along the western margin of Snake Valley, and may account for this depression. However, the distinctive structural feature of the north-south trending mountainous belt formed by the Snake and Deep Creek Ranges, is that of the upwarped décollement plane. The upwarped nature of this belt was commented on by a number of the early workers. The possibility exists, however, that this warp may be an earlier feature that has been accentuated by the formal faulting.

Microfilm \$2.65; Xerox \$9.20. 203 pages.

SIGNIFICANCE OF COMPOSITIONAL AND TEXTURAL PROPERTIES OF SOUTH CANADIAN RIVER CHANNEL DEPOSITS, NEW MEXICO, TEXAS, AND OKLAHOMA.

(L. C. Card No. Mic 59-2969)

Jerome Marvin Pollack, Ph.D. The University of Oklahoma, 1959

Major Professor: Associate Professor Doris Malkin Curtis

The size distribution parameters and mineralogical composition of South Canadian River channel deposits remain essentially constant over about 700 miles of river distance. Quartz-feldspar ratio does increase significantly downstream, but only in two size grades.

Mean roundness, mean sphericity, and mean shape factor values of particles of some minerals in the channel sediment increase downstream, while these values decrease for others. However, most minerals show no significant variation in these properties either downstream or between size grades. It is believed that in the sediment studied, the geometric configuration of a particle is dependent on the mineralogy and size of the grain. In addition, there is no interrelationship between the geometric properties.

Sorting on the basis of shape or roundness, and tributary dilution are both considered insignificant factors in the South Canadian River.

It is suggested that many of the generalizations concerning the nature of sediments or sedimentary particles are invalid when applied to a particular environment, even when such generalizations are drawn from the study of one river and applied to another river.

Microfilm \$2.00; Xerox \$5.60. 114 pages.

GEOLOGY OF THE BOKTUKOLA SYNCLINE AREA OF THE OUACHITA MOUNTAINS OF OKLAHOMA.

(L. C. Card No. Mic 59-3288)

Orville Berlin Shelburne Jr., Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Lewis Cline

As mapped for this report the Boktukola syncline area includes 316 square miles in the central Ouachita Mountains in McCurtain, Pushmataha, and LeFlore counties. The purposes of this investigation were to study the stratigraphy and structure of the outcropping rocks, to prepare a geologic map showing distribution of the rocks; and with the aid of data from these studies augmented by paleo-current studies to arrive at conclusions concerning paleogeography and geologic history.

Outcropping rocks are Late Mississippian and Early Pennsylvanian; they are in ascending order, Stanley group, Jackfork group, Johns Valley formation, and Atoka formation. The rocks are a thick flysch facies aggregating 23,000 feet; they were deposited in a rapidly subsiding trough, the Ouachita geosyncline. Flysch characteristics include rhythmic alternation of shale and sandstone, abun-

dance of sole markings and convolute bedding, presence of bedded dark chert and intraformational slump structures, and paucity of fossils, coarse cross-bedding, and ripple mark.

Formations of the Stanley group, described from outcrops in the western Ouachitas, are present in the Boktukola syncline. The formations are, in ascending order, Tenmile Creek, Moyers, and Chickasaw Creek. The oldest rocks exposed in the area are in the lower Tenmile Creek formation. The formation consists of green and gray shale with some graywacke; the name Battiest chert member is proposed for a persistant marker bed which occurs near the middle.

The Moyers formation consists of 1,150 feet of green shale, friable sandstone, and resistant gray sandstone. A thin discontinuous siliceous shale, which is locally intruded by sandstone dikes, marks the base of the formation.

The Chickasaw Creek formation marks the top of the Stanley group; it consists of 140 feet of dark siliceous shale, radiolarian chert, and quartzitic sandstone.

The formations of the Jackfork group are, in ascending order, Wildhorse Mountain, including the Prairie Hollow member, Prairie Mountain, Markham Mill, Wesley, and Game Refuge. Most of the siliceous shales which mark the boundaries of the formations in their type areas in the western Ouachitas are not present in the Boktukola syncline; therefore, the Prairie Mountain and Markham Mill formations can not be adequately separated. The Jackfork group is 55 percent subgraywacke and quartzose sandstone, and 45 percent gray shale. Spicular chert occurs in the Wesley formation. The group thickens eastward, toward the source area; it is 5,400 feet thick in the Harris Creek syncline and 6,500 feet thick in the eastern Boktukola syncline.

The Johns Valley shale is recognized in the area; however, exotic boulders or the Caney fauna have not been found. A Morrowan sandstone mold fauna, Honess' "Morrow fauna", occurs in lenticular sandstones in the middle Johns Valley.

An unknown thickness of the Atoka formation has been removed by erosion but 6,800 feet remain in the Boktukola syncline. The formation is about 75 percent shale and 25 percent quartzose sandstone. The lower Atoka is probably Morrowan; it contains a mold fauna, similar to that of the Johns Valley, and spicular siliceous shales.

The Boktukola fault is a steeply dipping thrust with a maximum displacement of six miles and a trace of thirty miles. It is not a reasonable vehicle for low-angle over-thrusting.

Primary sedimentary features typical of a flysch facies are common. Flute and groove casts are similarly alined throughout the sequence. They indicate paleo-currents moving from east to west, parallel to the geosyncline. Sediment transport was longitudinal and the source area lay to the east. The lack of post-depositional torsion of the trends of sedimentary features indicates that the Ouachita orogeny was not so intense as some workers suppose. Microfilm \$2.05; Xerox \$7.20. 155 pages.

be underlying metamorphic basement comple

# LATE PALEOZOIC STRATIGRAPHY AND PALEOTECTONICS OF CENTRAL AND EASTERN IDAHO.

(L. C. Card No. Mic 59-3230)

Maurice Ray Thomasson, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor L. R. Laudon

Recent detailed studies in central and eastern Idaho allow revision of the Late Paleozoic stratigraphy and paleotectonics. Three tectonic features controlled sedimentation; a western positive element, a slightly negative eastern shelf area, and a rapidly subsiding (Muldoon) trough aligned N 30° W between these two elements. The Milligen, Muldoon (new name), Wood River, and Lemhi (new name) formations are recognized.

The Milligen-Wood River contact is an hiatus which is represented by the Muldoon formation, approximately 10,000 feet thick, deposited in the Muldoon trough. Deposition was continuous from the Milligen into the Muldoon in the trough. The Milligen, in the type area, contains radiolarian cherts and mudstones suggesting deep water deposition, probably as a Lower and Middle Paleozoic

fondothem deposit.

The Muldoon formation is subdivided into the Copper Creek, Garfield, Iron Mine, and Wildhorse members in ascending order. Facies and directional current studies support a source area to the southwest. Petrographic studies suggest the Milligen in the west as a probable sediment source. The Muldoon is a flysch series consisting of a pelitic facies of black limestones and mudstones, and a psammitic series of graded immature graywackes ranging from 1 millimeter to 43 feet thick. Graded limestones are also present. Upper Mississippian ostracods occur in the Garfield member. Turbidity currents produced the graded psammitic units and paleocurrent data indicates these currents were directed down the flanks of the trough from the southwest and northeast. Some currents paralleled the trough resulting in longitudinal basin filling.

The Wood River-Muldoon contact is conformable in the Muldoon trough but the Wood River climbs through time to the west, overlapping unconformably the western source area. The Wood River is subdivided on a lithologic basis into the Hailey, Slate Creek (Desmoinesian-Missourian), Lake Creek (Virgilian), and Wilson Creek (Wolfcampian) members. The Hailey conglomerate is late Morrowan where it interfingers with the limestones east of the Muldoon trough. In the west the upper boundary is Desmoinesian. A gradation upward from immature graywackes to supermature orthoquartzites occurs in the Hailey conglomerate and resulted from a western source area providing sediment which filled and spread across the Muldoon trough. Sandstone equivalents of the conglomerate occur 50 miles to the east in the Lemhi Range. The Wood River facies and paleocurrent data indicate a source to the west.

The Lemhi formation (replaces "Brazer") was deposited on the eastern shelf. It ranges from Meramecian through Wolfcampian in age and is 6,950 feet thick at the type section in the southern Lemhi Range. It contains abundant algal, coral and bryozoan bioherms and biostromes. Cross-stratification, edgewise limestone con-

glomerates, bottom scouring, cyclic sedimentation, oolite beds and calcaronites indicate shallow water deposition on a carbonate bank similar to the Bahamian bank of today.

The Muldoon and Wood River formations are time equivalents with the Lemhi formation. A very rapid facies change occurs from carbonates to clastics in the Mississippian through Derryan units along the margin of the Muldoon trough.

The tectonic history in central Idaho includes three orogenic pulses. One minor pulse in the Lower Mississippian produced the Copper Creek clastics (860'). A second, stronger pulse resulted in the Iron Mine clastics (3,600') in late Chesterian and a third pulse produced the Hailey conglomerate (1,900') in Morrowan through Derryan. This coincides in space and time with the Antler orogeny in Nevada.

Directional current features in the Muldoon and Wood River formations include cross-stratification, convolute stratification, flame structures, slumps, flute, groove and lineated load casts, ripple marks and aligned plant fragments. These were collected over a 60 mile outcrop belt and analyzed statistically. Primary sedimentary structures are described and their mode of formation and environmental significance is discussed.

Microfilm \$3.70; Xerox \$12.60. 288 pages.

STRATIGRAPHY AND OSTRACODA OF THE BROWNSTOWN AND TOKIO FORMATIONS—SOUTHWEST ARKANSAS,

(L. C. Card No. Mic 59-3085)

Carl Peter Elmer Thorsen, Ph.D. Louisiana State University, 1959

Supervisor: Professor Clarence O. Durham, Jr.

A study was made of the stratigraphy and Ostracoda of the Gulf Cretaceous Brownstown and Tokio formations of southwest Arkansas as part of a project by the Graduate School of Geology, Louisiana State University, to better understand the Upper Cretaceous stratigraphy of the Arkansas-Texas area.

Surface sections of the Brownstown and Tokio were measured, described and systematically sampled where-ever the formations were sufficiently well exposed. A diagrammatic east-west stratigraphic section of the Tokio, based on surface sections, is presented to illustrate the facies changes experienced by the formation. In addition, three regional subsurface stratigraphic sections were constructed to demonstrate the relationship of the Brownstown and Tokio to adjacent formations and to illustrate the correlation of the Arkansas section with east Texas and northwest Louisiana.

The presence of an unconformity was demonstrated near the middle of the Tokio formation in southwest Arkansas which divides the formation into an upper and a lower member. The lower member is truncated and overlapped in a northeasterly direction.

A sequence of interbedded chalk and chalky marl within the Brownstown formation of Arkansas is considered to be the eastward extension of the Gober Chalk of Texas. This suggests that the portion of the Brownstown which overlies this chalk sequence in southwest Arkansas is younger than the Brownstown formation of Texas since the base of the Gober Chalk marks the top of the Brownstown in Texas.

The basal portion of the Brownstown formation is considered to have been deposited in a partially restricted basin environment. This resulted in the exclusion of an abundant fauna from the lower Brownstown and is probably responsible for the absence of Exogyra ponderosa from the basal portion of the formation. The lowest observed occurrence of E. ponderosa at the surface in this area is approximately thirty feet above the base of the Brownstown.

A total of 40 species of Ostracoda representing 17 genera were described and illustrated from surface samples of the Brownstown and Tokio formations collected in southwest Arkansas and southeast Oklahoma. Of these, 20 species have not been previously described. Four species of Ostracoda from the Brownstown and one species from the Tokio are considered to be reliable markers for these formations in this area.

On the basis of the Ostracoda, it is concluded that the Tokio formation is of the same age as the type Austin of Texas, that the type Brownstown formation is partially equivalent to both the upper portion of the type Austin and the basal portion of the type Lower Taylor groups of Texas, and that there is no depositional break in the Arkansas section which is equivalent to the type Austin-Taylor contact Microfilm \$2.15; Xerox \$7.60. 164 pages.

## HEALTH SCIENCES

# HEALTH SCIENCES, GENERAL

SERUM LIPID RESPONSES OF YOUNG MEN, YOUNG WOMEN, PREGNANT WOMEN AND MIDDLE-AGED WOMEN AFTER INGESTION OF HIGH FAT AND HIGH CARBOHYDRATE TEST MEALS.

(L. C. Card No. Mic 59-3817)

Ninfa Aguilar Saturnino, Ph.D. State University of Iowa, 1959

Chairman: Dr. Margaret A. Ohlson

Serum chylomicrons, optical density, total lipids and phospholipids of 40 subjects were determined at fasting and at intervals following test meals which included specified amounts of either butter, hydrogenated fat, corn oil or jelly. The subjects were 10 women between the ages of 21 and 23 years, 10 men ranging in age from 20 to 25 years, 10 middle-aged women between the ages of 49 and 69 years, and 10 pregnant women ranging in age from 23 to 27 years who were between their twenty-eighth and thirty-second weeks of pregnancy at the beginning of the study. The selection of these groups was based on expected variations in potential estrogen titer.

Of all the groups, pregnant women had the highest mean chylomicron, total lipid and phospholipid values at fasting. The middle-aged women showed mean fasting lipid values which were slightly lower than those of pregnant women but slightly higher than those of the young men. The fasting lipid values of the young women were of the same magnitude as those of the young men, except for the markedly lower, mean optical density reading for

Comparison of the lipid responses after the test meals showed that chylomicrons and optical density followed a similar pattern during the period of the study, although the magnitude of the increases or decreases differed. Values for total lipids and phospholipids showed slight changes after the test meals.

Highest lipid values for all groups occurred after the hydrogenated fat meal; maximum lipid concentrations

were determined at the fifth hour. On the other hand, butter showed fast absorption rates and maximum serum values occurred at the third hour. Lipid values at the seventh hour were higher after the corn oil test meal than following either of the other fat test meals. After the ingestion of jelly, half of the subjects including the majority of the pregnant women showed rises in total

lipids and phospholipids.

The middle-aged group showed highest lipid values after the high fat test meals; responses of the young groups of both sexes differed only slightly. Increments for total lipids and phospholipids of the pregnant women differed slightly from those of the middle-aged group; however, chylomicron and optical density increments of the former were lower than those of the young groups. It is suggested that estrogen may help in the clearing of chylomicrons from serum after a high fat meal.

Microfilm \$2.00; Xerox \$6.40. 131 pages.

# HEALTH SCIENCES, PHARMACY

THE PERMEABILITY OF RED CORPUSCLES TO VARIOUS SALTS OF GLUCONIC ACID.

(L. C. Card No. Mic 59-3534)

Howard Carl Ansel, Ph.D. The University of Florida, 1959

The adjustment of solutions intended for intravenous administration to the same tonicity as blood is of utmost importance. The advantages of employing the hemolytic method in the preparation of such solutions have recently been emphasized. The osmotic effect of a substance on the erythrocyte depends not only on the concentration of the substance but also on whether or not it penetrates or affects the properties of the cell membrane. Thus solutions calculated to be isosmotic with blood according to

physicochemical data are not necessarily isotonic to the red blood cell.

The purpose of the present investigation was to determine i values for various salts of gluconic acid by both the freezing point depression and hemolytic methods.

Sodium and potassium gluconates gave hemolytic i values which were approximately 25 per cent higher than those obtained by the freezing point depression method; this difference was only half as great when the hemolytic determinations were conducted in the presence of 0.2 per cent sodium chloride.

Magnesium and calcium gluconates gave higher i values by the hemolytic method than by the freezing point depression method when human erythrocytes were employed and lower ones when rabbit erythrocytes were used. The addition of 0.2 per cent sodium chloride raised the hemolytic i values of these salts when rabbit blood was used and lowered the values when human blood was used.

Manganese(II) gluconate gave slightly higher and cobalt(II) gluconate slightly lower i values from hemolytic data than from freezing point data.

The unusually low hemolytic i values obtained for iron(II) gluconate were, in the main, attributed to the instability of the solutions. The extremely high hemolytic i values obtained for zinc gluconate were due to the partial precipitation of the oxyhemoglobin liberated from laked erythrocytes making the colorimetric readings misleading.

Hemolytic i values of the gluconates were generally lowered when determined in the presence of sodium chloride.

Erythrocytes from Negro donors were, on the average, more resistant to osmotic hemolysis than those from Caucasian donors.

Results substantiate the premise that solutions calculated to be isosmotic with blood according to colligative property data are not necessarily isotonic to the red blood cell.

Microfilm \$2.45; Xerox \$12.60. 187 pages.

COMPREHENSIVE STUDIES ON UTAH GROWN MEDICINAL RHUBARB.

(L. C. Card No. Mic 59-3299)

Richard Lester Workman Jr., Ph.D. University of Utah, 1959

Chairman: L. David Hiner

The National Formulary, tenth edition (N.F.X), limited the source of medicinal rhubarb to China. This was a further limitation to the previous United States Pharmacopoeia and National Formulary limitation that this drug must be grown in China and Tibet. The short supply of Chinese rhubarb during World War II emphasized the fact

that this drug would not be available for importation during times of crisis in the Far East. Studies to determine the possibility of growing rhubarb which would meet N.F.X standards in the United States were prompted by this shortage.

Although medicinal rhubarb will grow in Massachusetts, Illinois, and Minnesota, it has been reported that the rhizomes and roots have an emetic action rather than the desired laxative effect. Because of the climatic and altitudinal differences between these areas and the state of Utah, it was thought important to try to grow this drug in Utah, and if it would grow, to see if the roots and rhizomes would have the desired laxative effect.

The plants used in this investigation were virtually unattended between 1948 and 1956. They were cultivated and watered during the last three growing seasons of 1956, 1957, and 1958. The roots and rhizomes were harvested, peeled, and dried during the late fall of 1958.

After the roots and rhizomes were dry, routine macroscopic and microscopic tests were performed. The Utahgrown roots were somewhat smaller than the N.F.X description, but were of the same color and texture. Microscopic measurements revealed that the starch granules of the Utah-grown medicinal rhubarb were about the same size as those found in the official product, while the calcium oxalate rosette aggregate crystals were somewhat smaller.

The N.F.X tests for anthraquinone, emodin, and crysophanic acid were all positive. The N.F.X test for dilute-alcohol soluble extractive revealed that the Utahgrown medicinal rhubarb contained thirty-five per cent dilute-alcohol soluble extractive while the Chinese rhubarb used as a control contained thirty-nine per cent. Rhaponticin was not present in the Utah medicinal rhubarb.

The comparative laxative activity of the fluidextract of Utah medicinal rhubarb and Chinese rhubarb were determined in albino mice. The results obtained showed that there was no significant difference in the laxative activity of the two fluidextracts.

A panel of forty-five people conducted organoleptic comparison tests with the fluidextracts, aromatic tinctures, and aromatic syrups of Utah medicinal rhubarb and Chinese rhubarb. This panel preferred the fluidextract and aromatic tincture made with the Utah medicinal rhubarb and the aromatic syrup made with the Chinese rhubarb. Only one panel member reported any nauseating qualities in the preparations made with the Utah medicinal rhubarb, while three panel members reported some nauseating qualities in the preparations made with the official rhubarb.

The results of this investigation indicate that further studies should be conducted to determine if this product can be grown over a wide enough area in Utah to make it economically attractive for Utah farmers to grow. If this is possible, the necessary steps should be taken to have Utah-grown medicinal rhubarb admitted to the National Formulary.

Microfilm \$2.00; Xerox \$3.00. 55 pages.

#### HISTORY

HISTORY, GENERAL

THE DEVELOPMENT AND OPERATION OF AN AMERICAN LAND SYSTEM TO 1800.

(L. C. Card No. Mic 59-3237)

Phyllis Ruth Abbott, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Merrill Jensen

The development of an American land system was a long and involved process. Before Congress could establish a permanent policy, numerous problems had to be solved -- many of them dating back to the founding of the colonies and Great Britain's long struggle with France for control of the interior of the North American continent. Standing in the way of the creation of the national domain, the establishment of a form of government for the interior, and the establishment of a land disposal system were the claims of foreign powers, of Indians, of several states, of land companies, and of individuals. These factors which stood in the way of the creation of a permanent policy for the West also hindered efficient operation of any legislation governing the interior.

It is the purpose of this study to discuss the problems which the revolutionary, confederation, and early national congresses faced, how and why these problems had developed, and how they were solved. The terminating date for the study has been set at 1800, since by the beginning of the nineteenth century, all claims against the lands northwest of the Ohio River had been extinguished and for the first time Congress was able to pass a workable land law.

Since the amount of published source material is so voluminous for a study of this kind, only slight use was made of manuscripts. It was believed, however, that the use of manuscripts would have changed the study only in detail and not in its general conclusions.

Microfilm \$5.80; Xerox \$20.40. 456 pages.

THE MISSOURI INTERESTS OF LOUIS HOUCK,

THE THEORY OF STREET STREET, STREET STREET, ST

(L. C. Card No. Mic 59-455)

William Thomas Doherty, Jr., Ph.D. University of Missouri, 1951

Adviser: Lewis Atherton

Although Louis Houck was born in Illinois in 1840 and attended the University of Wisconsin, the major part of his life was spent in southeast Missouri where he became known as an "Empire Builder" and "Missouri's Foremost Historian." Before he married into a propertied family of

that section and settled in Cape Girardeau, Louis Houck had had a versatile career. He had been an editor, a lawyer, a reporter for the Missouri Republican, and assistant United States District Attorney in St. Louis. He had published A Treatise on the Mechanics Lien Law in 1867, A Treatise on the Law of Navigable Rivers in 1868, and had edited the first fifteen volumes of the Missouri Reports in 1870.

From 1870 to 1925 Louis Houck's primary interest was transportation, which included the construction of a macadamized road connecting Cape Girardeau County with other southeast Missouri counties. The only railroad construction in southeast Missouri had been accomplished by the St. Louis, Iron Mountain system before Houck connected Cape Girardeau by rail to this network. Before his death in 1925, Houck had fashioned three railroad systems radiating north, south, and west of the river town and had secured eastern connections in the neighboring state of Illinois. Since his three systems of railroads, which totaled approximately 500 miles, intertwined with the Missouri Pacific and the Cotton Belt, much colorful litigation ensued between the Houck roads and lines controlled by the Gould interests. The St. Louis-San Francisco Railroad purchased a major portion of the Houck lines in 1902, and by 1913 Houck's control of railroads in southeast Missouri had virtually ended.

Louis Houck manifested interest in various projects in southeast Missouri. He attempted to locate a branch penitentiary in Cape Girardeau, and to stimulate manufacturing, newspaper establishments and churches. He served on the Southeast Missouri State Teachers' College board of regents the last thirty-nine years of his life. A controversy between Houck and the Little River Drainage District developed during the decade, 1909-1919.

When over sixty years of age, Louis Houck published several historical works: The Boundaries of the Louisiana Purchase in 1901, A History of Missouri in 1908, and The Spanish Regime in Missouri in 1909. Over twenty years of labor and part of his fortune went into these books. Outstanding research assistance was given Houck, and such factors as the translation of foreign documents from Spanish archives, original archaeological excavation in Missouri, and much factual biographical detail meant that Houck achieved a prominent and unique place in Missouri historiography. Houck gave further expression to his historical interests by making speeches employing historical themes, aiding other historians, and bequeathing historic names to several southeast Missouri towns. Because of his diverse interests as lawyer, pioneer railroad builder, educator, and historian, Louis Houck was one of the most versatile citizens of his state.

Microfilm \$5.40; Xerox \$19.00. 421 pages.

# HISTORY, MEDIEVAL

EDWARD I'S GREAT COALITION: DIPLOMATIC ASPECTS OF HIS WAR WITH PHILIP THE FAIR, 1294-1297.

(L. C. Card No. Mic 59-3312)

Roscoe Arthur Balch, Ph.D. University of Washington, 1959

Chairman: Henry S. Lucas

In 1294, after thirty-five years of peace, war broke out between Philip the Fair of France and his vassal in Aquitaine, Edward I of England. A seamen's quarrel, obscure and complex in origin, raised the issue. How should this conflict, seemingly less grave than many which patient diplomacy had earlier overcome, be settled?

Philip argued that the usual ways--negotiations, appointment of commissions or papal arbitration--were beneath the dignity of the French crown. He demanded that Edward I appear as an accused criminal before the Parlement. Philip's insistence upon his royal rights clashed with the Christian feudal ideal of Europe as one great family, the ideal shared by Philip's grandfather, St. Louis, Edward I and Boniface VIII.

Although Edward offered to supplement a diplomatic settlement with a marriage agreement which would have

eventually separated the duchy of Aquitaine from the English crown, Philip was adamant. His realm could produce at least three times as much revenue as Edward's.

Philip was young and confident.

Resolutely, Edward, utilizing his great European experience and his carefully nurtured group of royal servants, set out to contain Philip by building a great coalition. Edward had a son-in-law in Brabant and also in Holland and in Bar, a brother-in-law in Castile, a cousin in Savoy. All of these joined. Adolf of Nassau, king of the Romans, was willing to serve as co-leader of the alliance. Adolf and Count Floris V of Holland brought the archbishop of Cologne and many lesser lords to serve the cause for money.

Philip's aggressive policy had made enemies. Among these Edward found his staunchest allies--barons with Imperial sympathies in Palatine Burgundy, the count of Bar, and Philip's great vassal, Guy de Dampierre, count of Flanders.

But at home difficulties arose. Edward's summoning of Welsh troopers had provoked a rebellion, not quelled until 1295. When the Scots nobles were called for service, they refused and allied with Philip. Edward lost 1296

subduing them.

In 1295, Boniface VIII tried to mediate the Philip-Edward quarrel. Although Boniface disliked the coalition, Edward cooperated; Philip was less enthusiastic. Hoping to force peace negotiations, Boniface, in 1296, forbade the clergy in both realms to pay taxes for war. Edward's clergy obeyed; Philip's did not. The pope slowly modified his decree. But Edward had been hurt.

Internal quarrels, which Edward strove to mediate, tore the unity of his allies. Particularly bitter was that between Holland and Flanders. Floris V's cousin, John of Hainault, also hated the Flemish counts of the Dampierre house. Though an Imperial vassal, John found support from Philip.

Skillfully exploiting these difficulties, Philip sought to disrupt Edward's coalition. Acting through John of Hainault, Philip won over Floris V and paralyzed Adolf of Nassau.

A desperate plot of Edward's men to kidnap Floris ended in the latter's murder. Completing the promised marriage between Floris's son John and his own daughter, Elizabeth, Edward forestalled Philip in Holland.

But in the spring of 1297, many English barons were opposed to the Flanders alliance and, exasperated by Edward's many demands, refused money and military service.

Philip was invading Flanders. Grimly, Edward joined his allies with a small force. Adolf hesitated; Brabant waited for promised funds Edward could not raise; the Hollanders stayed home. Edward's combined force was too small to take the offensive but he seized a strong defensive position and Philip dared not attack. Philip's Scots friends raided northern England. Edward's allies struck Philip in Burgundy.

Stalemated, the kings accepted papal arbitration.
Edward's own rights were fully upheld, but he could not secure the aims of his allies. Edward had, however, forced Philip back, temporarily, within the framework of

an ordered Christendom.

Microfilm \$7.00; Xerox \$24.00. 549 pages.

## RABBI HAYYIM ELIEZER BEN ISAAC OR ZARUA, HIS LIFE AND WORK, AND A DIGEST OF HIS RESPONSA.

(L. C. Card No. Mic 59-3006)

Rabbi Noah Goldstein, D.H.L. Yeshiva University, 1959

A thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Hebrew Literature in the Bernard Revel Graduate School of Yeshiva University.

The dissertation contains a detailed description of the life, and work of Rabbi Hayyim Eliezer ben Isaac Or Zarua; a careful study of his Responsa (written replies to questions of a legal or religious nature that were submitted to him); the systematic collection of scattered and interspersed data and facts, and their reconstruction into a picture of various phases of Jewish life in Germany in the second half of the thirteenth century; and a digest of the Responsa, wherein the questions presented and the decisions rendered are stated in concise and succinct form, thus making the historical material more readily available to historians who can not use these Responsa in the original. Microfilm \$3.20; Xerox \$11.00. 247 pages.

THE MAKING OF STATUTES IN FRENCH PROVINCIAL COUNCILS 1049-1305.

(L. C. Card No. Mic 59-3266)

Richard Lorin Kay, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Gaines Post

Provincial councils were held widely and frequently in the thirteenth-century Church, when new ideas of representation and consent were being developed in theory and practice. Although certain aspects of provincial councils as representative assemblies have been studied, their procedure has been neglected. In an effort to establish a basis for further procedural studies, this dissertation concentrated on one aspect of the procedure of provincial councils as seen in the largest and most typical body of evidence available. The problem was to ascertain the functions of the head and members of the provincial council in the making of statutes. The chief source was the statutes made in twelve French provinces during the thirteenth century, although the few French statutes from the period 1049-1215 were also utilized. These statutes, largely as printed by Mansi, were selected as a characteristic and coherent sample that was relatively free from extraneous problems.

In Part I, eighty-three cases were examined to determine who performed the legal act of making a statute, i.e. who was the subject of such enacting words as nos statuimus. The enactor could be identified in a majority of cases, and it was concluded that normal statutes of thirteenth-century French provincial councils ran in the name of the metropolitan alone.

References in the statutes to deliberation, counsel, and consent were analyzed in Part II in an attempt to discover the nature of the conciliar proceedings preparatory to the metropolitan's enactment of statutes. Although the use of formulas such as provida fuit deliberatione statutum was influenced by the rhetorical requirements of the cursus, these phrases show that the metropolitan normally sought information and advice in his council so that he might act with greater certitude, foresight, prudence, and piety. Counsel and consent were attributed by the statutes with regularity only to the suffragans, which strongly suggests that they alone had a general right to give counsel and decisive consent. The precise rights of lesser members were not clearly discernible, but the variable composition and irregular mention of these members indicates that their participation was not necessary to the validity of the statutes. Little distinction seems to have been made between the counsel of the suffragans and that of other members, except that the former may have counselled as a separate group. Expressions of consent in the statutes appear more likely to refer to procedural consent, counsel, or ineffectual approval, than to decisive consent. The terms consensus or assensus are used for decisive consent, but like other consensual expressions, they also are used in reference to non-decisive consent.

Taken by themselves, the statutes contain only the bare outlines of conciliar procedure. They suggest that the relation between metropolitan and suffragans is the decisive one in the making of statutes, and moreover it is shown that this relation frequently is that of the head of an ecclesiastical corporation to its members, since suffragans

are frequently found to form a provincial chapter which is the core of the metropolitan's council.

The study concludes with a sampling of the views of canon lawyers that confirms the interpretation of the statutes and suggests further lines of research. A critical repertory of the sources is appended.

Microfilm \$3.15; Xerox \$10.80. 241 pages.

# THE CHRISTIANIZATION AND COLONIZATION OF THE LANDS EAST OF THE ELBE.

(L. C. Card No. Mic 59-1793)

Richard Rudolph Syre, Ph.D. University of Nebraska, 1959

Adviser: Edgar N. Johnson

Between the tenth and the fourteenth centuries western Christianity experienced a significant eastward extension which resulted in the Germanization of territories once occupied by western Slavs, Baltic Slavs, and Finnish tribes along the Baltic Sea. This demonstration of the vitality of the western Church was heavily indebted to the German state, whose patronage of the cause of missions came to be identified with martial methods. The want of enthusiasm of the German Church for missionary labor was matched by the mounting hostility of the Slavic tribes beyond the river Elbe to Christianization. Unable to resist the impatient German military pressure, the Transelbian principalities of the Wagrians, Obodrites, Liutizi, Hevelli, and Sorbs were shattered. Their inhabitants, opened to a double vengeance for being pagan as well as foe, were oppressed, scattered, and eradicated. Their lands were taken in the twelfth and thirteenth centuries by a tide of German colonists who Christianized the Slavic remnants by Germanizing them. The major concern of this thesis has been the role which the German colonization movement came to play in the progress of the western Church. This involved the political and military conflicts which determined the direction of the movement from the Elbe-Saale line northeastward into the Slavic territories later occupied by the principalities of Holstein, Mecklenburg, Brandenburg, Silesia, Pomerania, and Prussia.

The secular Church as a missionary and colonizing institution was aided by the ancillary labor of the monastic and knightly orders from the twelfth to the fourteenth century. While the colonizing activity of the monastic orders was not essentially different from that carried on by the secular Church and the native and German aristocracy, it deserved a special emphasis in the study. The Premonstratensian and Cistercian monks entered the German colonial territory as pioneer settlers and became important feudal landlords. The monastic orders of the twelfth and thirteenth centuries (before this time we can speak only of individual monasteries) brought to their task the Benedictine devotion to manual labor, while combining stability with ardor for souls. Their impact was massively enlarged when central organization and surveillance had lent greater mobility to their corporate resources. They broke the rural isolation of the German colonial east by becoming centers of spiritual and economic knowledge, and thus often completed the process of Christianization.

Their rural interest and orientation supplemented the more urban interests of the secular Church. By opening their vacant lands to German peasant settlement the monasteries furnished members for the anemic parishes of the eastern bishoprics. The remaining Wends either accepted the new economic and religious order or migrated eastward into still pagan lands.

Successful employment of German peasant settlement was the prerogative of no particular institution. Slavic nobles, abbots, knights, and bishops in the colonial territories learned to employ this new instrument for the rapid transformation of their lands. The widespread use of colonization schemes filled once sparsely settled areas with sturdy Christian peasant communities. Their prosperity supported a network of new towns, and their liberalized feudal relations resulted in strong principalities whose rulers came to rank among the most powerful of the empire.

The incentive to colonization was rarely service to Christian missions, and nowhere was colonization more audaciously used for the increase of territorial power to the landlord than in the Prussia of the Teutonic Knights. The Order had engaged in a series of military campaigns with the avowed purpose of compelling Christianization, but it inflicted upon the defeated Prussians a program of German settlement which exceeded all others in massiveness, uniformity, and planful direction. The Knights succeeded by these means in creating a Christian state which stretched from Pomerania to the Gulf of Finland, and demonstrated within a century the impressive achievement of having created by colonization a powerful state. The Order had advanced the spread of the western Church by compulsive Christianization and the adroit use of colonization, but in the process had become paganized. It opened itself to the dual charge of having perverted the missionary ideal into an instrument of oppression and the colonization movement into an implement of policy.

Microfilm \$3.35; Xerox \$11.40. 257 pages.

HISTORY, MODERN

THE FOUNDATIONS OF AMERICAN MILITARY POLICY (1783-1800).

(L. C. Card No. Mic 59-2965)

Richard Hobbs Fraser, Ph.D. The University of Oklahoma, 1959

Major Professor: Edwin C. McReynolds

The Revolution demonstrated the weaknesses of the American military system, which was based upon the use of two distinct types of troops, militia and regulars. Following the War, military theorists proposed measures to provide an adequate standing army and to reform the militia in line with federal standards. In general, their militia plans called for a small, highly-trained select corps and for reserves composed of the ordinary militia, the whole to be uniform in all the states.

The nationalists in Congress favored the proposals

because they would both enhance the military powers of the federal government and provide more effective defence forces. The anti-nationalists argued that the measures involved an unconstitutional extension of federal authority over the militia and that the enlarged federal armies might be used against the states and the people. They appealed to the traditional American fear of regulars, perfected the militia myth - the old belief that militiamen were always superior to standing troops - and insisted that complete reliance be placed upon the old-style militia. Throughout the period, the solution to the several problems was seriously affected by financial considerations and, after the adoption of the Constitution, by the general party conflict.

From time to time, the Congress under the pressure of military necessities found it expedient to make additions to the regular forces. In each case, however, the antinationalists forced cutbacks as soon as the threat had disappeared. Finally, the Federalists, led by Alexander Hamilton, developed the concept of provisional troops that would be organized in peacetime but embodied only after war began. In the French crisis of 1798-1800 they passed a complex military program that called for large numbers of these men as well as for a small augmentation of the regular forces. They also built up the Navy despite heavy Republican objections. The usual reductions followed, and when the Federalists fell from power in 1800 they had little to show for twelve years' effort.

Though the nationalists did put a "Uniform Militia Act" through Congress in 1792, it had been shorn of some of its most constructive features. An analysis of the state laws passed to implement the act shows that the measure produced some improvement, but that it did not replace the old militia with a materially altered arm. Nor did the "reformed" militia conduct itself with much greater efficiency than formerly in performing its missions. Furthermore, it became deeply involved in state conflicts over land ownership and in the bitter partisan quarrels between the Federalists and the Republicans during the French crisis.

The legislative measures of the period ignored the military lessons of the Revolution, and failed to adequately prepare the nation for defense emergencies.

Microfilm \$6.15; Xerox \$21.40. 482 pages.

GOVERNMENTAL ASSISTANCE TO IMMIGRATION TO NEW SOUTH WALES, 1856-1900.

(L. C. Card No. Mic 59-3254)

Albert Arthur Hayden, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor William L. Sachse

The practice of the government paying all or a part of the passage money for qualified immigrants was begun in 1831. With the devolution of responsible government on the colony in 1855, the colonial government assumed control over its immigration policy. This study is concerned with discovering those factors which determined whether or not the colony would grant assistance to immigration. The study is not concerned with the reasons that cause

people to emigrate. In view of this limited scope, the study relies heavily upon the New South Wales archives in the Mitchell Library, Sydney, on the parliamentary debates, and on the correspondence placed before parliament. Close attention has also been given the Sydney press, with some consideration of the country press.

The study has been presented chronologically, except for two topical chapters dealing with immigrants from countries other than the United Kingdom, and with various forms of indirect assistance.

Assistance was granted to immigration between 1856 and 1860, between 1861 and 1867, and between 1873 and 1896. When immigration was discontinued on the first two occasions, economic difficulties, highlighted by unemployment, and the views of the premier were contributing factors in the decision. The final discontinuance, which came in 1895, actually occurred in 1886 when economic recession caused the government to cease giving general assistance and to limit the policy to completing obligations already incurred.

Working class agitation, which had been present even in the eighteen fifties, increased during the seventies. From it developed an anti-immigration movement which was to have a bearing on governmental action when the colony began experiencing further economic difficulties in the eighties. While this agitation kept the issue before the public, the economic factor was the one of significance in causing the government to limit and finally to discontinue the granting of assistance to immigration. The working classes formed an articulate pressure group, but that was the extent of their importance. Even after the formation of the Labor party in the early eighteen nineties they did not have sufficient votes in the legislature to defeat the immigration estimate; the government simply did not present an estimate after 1895.

Microfilm \$3.75; Xerox \$13.00. 298 pages.

THE FAILURE OF RAILWAY LABOR LEADERSHIP: A CHAPTER IN RAILROAD LABOR RELATIONS, 1900-1932.

(L. C. Card No. Mic 59-2853)

James William Kerley, Ph.D. Columbia University, 1959

Supervisor: Dr. Harry James Carman

This work on THE FAILURE OF RAILWAY LABOR LEADERSHIP tries to depict the tensions that existed between management and labor in this vital American industrial service. For over half a century the leaders of the Railroad Brotherhoods and other parallel organizations failed to bridge the gulf which separated their positions. For more than fifty years, both Railway Management and Railway Labor seemed virtually unable to communicate, so fixed were they in their respective positions, and so committed were they to stylized vocabularies and restricted interpretations not only of the position of their opposite number but of their own position as well.

The DISSERTATION begins with a exegesis of the background of Railroad Labor prior to 1900. This violent era leads into the phase where resurgent labor resorted

to arbitration under the less antagonistic atmosphere of the "SQUARE DEAL" with its Elkins and Hepburn Acts. These pieces of legislation, coupled with Theodore Roosevelt's zealous pressure for arbitration of labor-management disputes, created a favorable climate for the growth of the Railroad Labor Movement. The enrollment of the Brotherhoods increased rapidly, but neither the understanding nor communication skills of either party grew apace, as is shown in the chapter on ARBITRATION, and the succeeding chapter on the NEW FREEDOM.

World War 1 brought government regulation. This period is explored with the Adamson Act as background, for this bill introduced new strides forward in Railroad Labor progress through arbitration. Yet the inescapable fact emerged - that labor's benefits accrued due to enlightened governmental action necessitated by the impetus of impending war, rather than by means of the mutual wisdom and cooperation of the leaders of Labor and Management.

It became clear to the rank and file of Railway Labor that the period of government regulation had bettered their working conditions, their remuneration, and had provided increased job stability. It was inevitable that Railway Labor should desire continuance of nationalization. It was equally evident that management would oppose such an arrangement, and, riding the tide of the anti-labor sentiments that prevailed after World War 1, management successfully resisted the movement for continued nationalization. Management's task was easier, because Railroad Labor leaders, again misjudging the prevalent point of view, assumed an overly-radical position, and succumbed to the strong counter tides against them. This signal failure of Railway Labor leadership to recognize the necessity of moderation caused a decline in Railway Labor's progress, and ushered in the period of Post War Turmoil.

The election of Warren Harding began the so-called period of "Normalcy". The leaders of Railroad Labor consistently refused or failed to recognize that they were living in a time of apathy or even of active hostility toward the entire labor movement. Their ill-timed and ill-considered proposals not only played right into the hands of management - with whom the government was now aligned - but also served to weaken labor solidarity by allowing a conservative Railway Labor Administration to assume control in place of the former overly-radical leadership. This conservative element even organized labor banks to try to compete in the open money market with management, using one of management's major tools.

Another faulty estimate of the situation was again shown by the now conservative labor leaders as the nation moved into the Depression and the New Deal. In a conservative atmosphere Railway Labor leaders were radical; now when liberalism prevailed, they were conservative. Repeated examples of bad-timing, coupled with over-stated or under-stated objectives leads this DISSERTATION to a conclusion - and title - of: THE FAILURE OF RAILWAY LABOR LEADERSHIP.

Microfilm \$3.45; Xerox \$11.80. 268 pages.

SEATTLE'S ECONOMIC DEVELOPMENT 1880-1910.

(L. C. Card No. Mic 59-3333)

Alexander Norbert MacDonald, Ph.D. University of Washington, 1959

Chairman: W. Stull Holt

Between 1880 and 1910 Seattle underwent more significant changes than in any other thirty year period in its history. During this interval it grew from a small hamlet of less than five thousand persons to a substantial metropolis of almost a quarter million persons. Virtually isolated at the beginning of the period, by 1910 its residents could go directly to the Atlantic Coast by any one of its three transcontinental railroad lines, or reach virtually any spot on the globe by its sixty odd steamship lines. By 1910 Seattle's economy was closely attuned to that of the entire nation whereas in 1880 such a contact was practically absent.

In one respect at least Seattle in 1910 was much like Seattle in 1880, for in both years the city was primarily a commercial and distribution center rather than a manufacturing center. Throughout the period the provision of a whole variety of goods and services to nearby communities on Puget Sound played an important role in the city's economic life, and accounted for a major part of Seattle's total employment.

The importance of this local supply trade meant that Seattle's growth in large part was an outcome of the growth of the entire region. When the demand for the region's lumber, wheat, fish, coal and agricultural produce was keen, the Pacific Northwest prospered and so did Seattle. For the city was called on to supply food, clothing and equipment for the actual producers of these raw materials as well as provide a variety of legal, financial and administrative services. Whether fresh meat was sent to a lumber camp on the Olympic Peninsula, hydraulic mining equipment shipped to a company in Alaska, or a bank loan made to a farmer in Yakima, they all were services provided by the city for its hinterland.

Any factor which tended to increase the production and export of the region's raw materials stimulated Seattle's growth. The gradual depletion of the lumber regions in the Great Lakes area, the construction of transcontinental railroad lines, and the establishment of low freight rates all contributed to increased rail shipments of lumber to the east. Rapid population growth in California kept cargo shipments of lumber to that area at a high level. Some of this lumber was manufactured in Seattle and gave direct employment to workers in Seattle's lumber mills as well as on its railroads and steamship lines. More important was the indirect impact of these exports, for they meant that numerous men and women in the city's stores, offices, banks and jobbing agencies were called on to provide goods and services to lumbering communities throughout the entire Puget Sound area.

Similarly any consolidation or expansion of the area tributary to Seattle also benefitted the city's growth. Whether the city's residents built wagon roads or railroads, sought terminal freight rates, acquired new steamship lines or banking facilities, all tended to expand the hinterland tributary to the city. As such, a steadily larger number of persons looked to Seattle for its needs.

Such a local supply trade was not the only cause of

Seattle's growth. For the desire of migrants to live in Seattle, the activity of local business leaders, a prosperous foreign trade, a favorable location and an early head start in the population race all played their part. But although such items assisted, it was the supply trade that played the critical role in Seattle's development as the metropolis on Puget Sound. By 1910 Washington's mills and ranches were more than able to meet the demands placed on them for lumber and wheat. As the rate of growth of the entire state slowed down, Seattle's growth too slowed down.

Microfilm \$4.55; Xerox \$15.40. 356 pages.

JEWS IN THE POLITICAL LIFE OF NEW YORK CITY, 1865-1897.

(L. C. Card No. Mic 59-1471)

Arthur M. Silver, D.H.L. Yeshiva University, 1954

# PROBLEM

The purpose of this study was to determine the political activities of the Jews of New York City from 1865 to 1897.

#### PROCEDURE

Through the use of the city's press, city and state documents and all the available Jewish press, the name of every Jewish candidate and appointed city official of that period was obtained. Using this information, together with a knowledge of the general history of the time, one can establish important relationships.

By examining the Jewish press and the official election returns of the Jewish-inhabited districts, one can determine the political attitude and voting habits of these Jews.

# SUMMARY

From 1865 to 1885, with few exceptions, the role of the Jews in politics was tied up closely with the German political movements.

About 1886, the "Jewish" element in politics emerged. Immigration to the city's East Side made the Jews a major factor of the population. In general, most Jews voted Democratic, as Tammany was more understanding and friendlier to all immigrants, including, naturally, the Jews. Therefore, in many elections, particularly presidential, the Republicans nominated a greater number of Jews, hoping thereby to draw more Jewish votes for their ticket and thus win the state.

Microfilm \$3.15; Xerox \$10.80, 241 pages.

THE FREEDMEN'S BUREAU IN LOUISIANA.

(L. C. Card No. Mic 59-1082) Howard Ashley White, Ph.D. Tulane University, 1956

Chairman: William R. Hogan

The Bureau of Refugees, Freedmen, and Abandoned Land, usually known as the Freedmen's Bureau, was established by act of Congress on March 3, 1865, and functioned until 1872. The agency was empowered to maintain complete control over all affairs pertaining to four million emancipated slaves, with the responsibility of protecting and aiding them in the transition from thralldom to freedom.

The Bureau assumed the guardianship of more than 330,000 released slaves in Louisiana. In addition to an attempt to provide protection and justice for them, the agency engaged in a program of relief, regulated labor, "socialized" medicine, and federal aid to education that constituted a vital part of a socio-economic experiment unprecedented in the United States.

Most constructive of the Bureau's activities were the agency's efforts to administer relief, provide medical attention and hospitalization for the sick, and to establish schools for Negroes. Destitute Negroes and whites received aid in times of distress caused by war, flood, and pestilence. Thousands of sick Negroes received medical care that substantially lowered the death rate among them. Laudable results were achieved in teaching elementary reading and simple arithmetic to freedmen.

Less successful were the Bureau's activities in providing justice, regulating labor, and training the freedmen in the responsibilities of citizenship. Although the agency curbed outrages that threatened freedmen's security of life and property and won for them the right to testify against whites in court, arbitrary actions by inexperienced agents enraged the white citizens of Louisiana who claimed, with the endorsement of certain high Bureau officials, that the freedmen were adequately protected by local civil authorities. Efforts to improve the moral behavior of freedmen or to induce them to work diligently were largely unavailing in the first flush of their new freedom. Economic pressures, rather than administrative devices, ultimately determined labor relations.

Attempts to divide confiscated land among freedmen angered white citizens without helping Negroes. President Andrew Johnson's policy of restoring such land to pre-Reconstruction owners, sanctioned by powerful economic interests in the North, halted the Bureau's efforts to open the way for freedmen to become property owners.

The effects of the Bureau's activities in Louisiana were both beneficial and unfortunate. Lack of funds, inadequate personnel, frequent changes in agents, and inefficiency and corruption even among high officials placed severe limitations on the Bureau's most positive accomplishments. These achievements were largely temporary, while the unhappy results of the agency's policies tended to become permanent.

The Bureau's most tragic mistake was its virtual coalition with Radical Republicanism, for efforts to enlist the freedmen in the party united against the Negroes all classes of whites, who otherwise might have split along economic lines. Out of the toils of Reconstruction, of which the Freedmen's Bureau was an integral part, came an inflamed racial hostility that has remained an important factor in keeping Negroes in a place near the bottom of the social and economic scale.

Records of the Bureau, now deposited in the National Archives at Washington, D.C., constitute the chief body of evidence. These records include 534 books and approximately 100 boxes of manuscripts dealing with Louisiana. Other sources are special collections at Tulane University, Louisiana State University, Fisk University, Howard University, the Library of Congress, and the Rosenberg Library, Galveston.

Microfilm \$3.90; Xerox \$13.20. 301 pages.

# HOME ECONOMICS

DIETARY AND BLOOD NUTRIENT LEVELS FOR A SELECTED GROUP OF CHILDREN AS DETERMINED BY DIETARY INTAKES AND BIOCHEMICAL MEASUREMENTS OF HEMOGLOBIN, ASCORBIC ACID, VITAMIN A, AND CAROTENE.

(L. C. Card No. Mic 59-2994)

Clinita Arnsby Ford, Ph.D. Kansas State University, 1959

A major problem in the evaluation of nutrition status has been the establishment of reliable indices. The data of several nutrition studies indicate that dietary and blood data do not always agree as to nutrition status. It was the purpose of this study to determine the dietary and blood nutrient levels of a group of children and to investigate

relationships among and between the dietary factors and blood nutrients.

Seven-day diet records and 20-ml samples of venous blood were collected from a group of eight- to 13-year-old children. All children received dietary and vitamin supplements. Dietary data were calculated for mean daily intakes of food energy, eight dietary nutrients, and eight food groups. Blood samples were analyzed for concentrations of hemoglobin, ascorbic acid, vitamin A, and carotene.

The 1958 revision of the National Research Council Recommended Allowances was the basis for judging the adequacy of nutrient intakes and of the total diet. Blood nutrient levels were determined by standards established by Bessey and Lowry.

A larger percentage of boys than girls consumed adequate diets. As age increased, the percentage of children

who consumed adequate diets decreased. Calcium was the most frequently deficient nutrient in the diets, and more so for girls than for boys.

Mean daily intakes of dietary nutrients and of food groups usually were higher for boys than for girls the same age. Food group intakes compared favorably with the National Food Guide recommendations, but milk consumption tended to be low. In general, neither the intakes of dietary nutrients nor of food groups changed signifi-

cantly with age.

Hemoglobin and plasma vitamin A tended to increase with age, whereas plasma ascorbic acid tended to decrease with age. Changes in plasma carotene with age were not consistent. When classified according to levels of nutrition, a majority of the children rated "excellent" for plasma ascorbic acid, "good" for plasma vitamin A, and "fair" for plasma carotene, and hemoglobin. Blood nutrient values for girls exceeded those for boys, except for hemoglobin.

Correlation coefficients for most pairs of dietary nutrients were positive and significant (P<.01). Only a few correlation coefficients were significant (P<.05) for pairs of food groups, and many were negative. Food group intakes tended to vary directly with total dietary adequacy. This relationship was significant (P<.01, boys; P<.001, girls) between milk and related products and dietary ade-

quacy.

Simple linear correlation coefficients for the following blood and dietary factors were significantly (P<.05 and .01) correlated: (1) plasma ascorbic acid and plasma carotene, dietary ascorbic acid, and vitamin C-rich fruits and vegetables; (2) plasma vitamin A and dietary vitamin A; and (3) plasma carotene and plasma ascorbic acid, dietary thiamine, and foods grouped as other fruits and

vegatables.

Multiple linear correlation coefficients for age, food energy, and eight dietary nutrients indicated that over half of the variation in blood nutrients remained unexplained. On the other hand, multiple linear correlation coefficients for age and eight food groups indicated that a major portion of the variation in blood nutrients was explained by these factors. Results of analyses of variance showed that the blood nutrients were not significantly affected by the level of dietary adequacy.

Microfilm \$2.40; Xerox \$8.40. 184 pages.

# SOME ASPECTS OF TRYPTOPHAN AND NIACIN METABOLISM IN HUMAN SUBJECTS.

(L. C. Card No. Mic 59-3295)

Virginia May Vivian, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor May S. Reynolds

Nitrogen balance, blood pyridine nucleotide (PN) levels and the urinary excretion of N'-methylnicotinamide (N-Me), N'-methyl-2-pyridone-5-carboxamide (pyridone) and 8 tryptophan metabolites were studied in 10 college women

transferred from a nutritionally adequate control diet supplying 680 mg. tryptophan and 10 mg. niacin to a semi-synthetic regimen providing 2.5 mg. niacin and 25 mg. tryptophan. Nitrogen intake remained constant at 10 gm. In Study I (4 subjects) the tryptophan content of the diet was increased stepwise to provide daily intakes of 25, 170, 220, 315 and 810 mg. in consecutive periods. In Study II (6 subjects) tryptophan was supplied at a level just sufficient to maintain nitrogen balance and the niacin intake was increased to provide 2.5, 5.0, 10.0 and 15.0 mg.

Nitrogen loss occurred on the 25 mg. intakes of tryptophan; nitrogen storage occurred when the tryptophan intakes were 160 mg. or above. Niacin supplementation

had no apparent effect on nitrogen storage.

In general, the excretion of the tryptophan metabolites followed the tryptophan intake. Even on low tryptophan intakes some excretion occurred suggesting that some tryptophan was always converted to niacin. Niacin supplementation had no apparent effect on the excretion of these metabolites.

In Study I the PN levels decreased following the depletion period (25 mg. tryptophan, 2.5 mg. niacin), continued to decrease until the tryptophan intake was 220 mg. and then gradually returned to normal. In Study II the PN values did not decrease following the first depletion or the subsequent period but decreased following the second depletion period which was introduced for that purpose. The PN values began to rise in the period with 160 mg. tryptophan and 5 mg. niacin, reached normal levels when the niacin intake was increased to 10 mg. and showed no further response on a 15. mg. niacin intake.

The pyridone and N-Me excretion levels dropped sharply when the subjects were placed on the semisynthetic regimen. In Study I these metabolites remained low until the tryptophan intake was increased to 810 mg. In Study II the pyridone levels began to rise when 160 mg. tryptophan and 5 mg. niacin were furnished and continued rising when the niacin intake was increased to 10 and 15 mg. The N-Me values began to rise when the 10 mg. of niacin was provided and continued to rise on the next period. In each study the excretion values of the niacin metabolites in the last period were about 50 per cent of

the values of the control period.

There was reason to suspect that the N-Me values in Study I were too high. A modification of the method of Huff and Perlzweig for the determination of N-Me was developed in which ion exchange resins were used instead of charcoal to remove interfering fluorescent substances from urine. A comparison of the N-Me values determined by the two methods revealed that when the N-Me content was low the revised procedure resulted in values one-fourth to one-half as high. The new method was used in the second study and, unlike the first study, the N-Me values were always lower than those of the pyridone.

The results of Study I indicated that tryptophan was utilized first to establish and maintain nitrogen balance, second for synthesis of blood PN and finally, when the PN values were nearly normal, there was an increase in the excretion of the niacin metabolites. In Study II, the niacin was apparently used first for PN synthesis and then there was an increase in the excretion of the niacin metabolites.

Microfilm \$2.45; Xerox \$8.40. 185 pages.

### JOURNALISM

ADULT PREFERENCES IN TYPOGRAPHY:
AN EXPERIMENTAL STUDY IN THE
COMMUNICATION FUNCTION OF
TYPOGRAPHIC DESIGN.

(L. C. Card No. Mic 59-3825)

Merald Ernest Wrolstad, Ph.D. State University of Iowa, 1959

Chairman: Professor Arthur M. Barnes

The utilitarian role of typography in the graphic arts was defined as the requirement to function at two levels in the communication process—at the reading or verbal level, and at the design or non-verbal level. This was an experimental study to investigate communication between the typographic designer and his audience at the latter level.

Data of the experiment were preferences by adults for examples of good typographic design when paired with poor counterparts. Five independent variables were used in the study: (1) Age of subjects, (2) Education of subjects, (3) Sex of subjects, (4) Symmetry of typographic design—symmetric and asymmetric approaches to typography, and (5) Principles of typographic design—Balance, Contrast, Proportion, Rhythm, and Unity.

Ten book title pages were used as examples of good typographic design. Using the two design variables—Symmetry and Principles—a poor modification of each example was designed. The examples were verified as to their appropriateness to the study by practicing typographers. A disproportional stratified sample of adults was interviewed to obtain preferences for the typographic examples.

The study posed two general questions: (1) when examples of good typography are paired with examples of

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study I were too high. A modification

poor typography, will adults prefer the good examples? and (2) what will be the effects of the five variables and their interactions on these preferences?

The major effects observed were:

- 1. No significant differences resulted between the total preferences of the adults for good design and preferences that might have been expected by chance selection. Examination of the amount of difference separating the good and poor examples suggested the interpretation that for adults the "good design" plateau is much broader than typographers have suspected.
- 2. Good symmetric designs received significantly more preferences than good asymmetric ones. This was especially true for the Contrast and Balance principles. For Proportion and Unity, good asymmetric designs were favored. For Rhythm, preferences for good symmetric and good asymmetric designs were equally divided. Symmetric design was especially preferred by the highest education group.
- 3. There were significant differences in the number of preferences for good examples for the five design principles, adding a statistical argument for the function of the principles within the framework of typographic design. This difference was especially true for the lower educational groups.
- 4. Young women made significantly more preferences that agreed with typographers than young men. This was especially true for the young men and women in the higher education groups for symmetric design examples.
- 5. The Education variable proved to be a valuable catalyst in its interactions with other variables, although by itself it did not produce significant preference differences. Effects of the variables Age and Sex were the least significant in over-all analysis of results.

Microfilm \$2.30; Xerox \$8.00. 174 pages.

# LANGUAGE AND LITERATURE

LANGUAGE AND LITERATURE, GENERAL

THE RELATION OF THEME AND SETTING IN THE MAJOR NOVELS OF HENRY JAMES.

(L. C. Card No. Mic 59-3170)

James Daniel Brasch, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Harry Hayden Clark

This study investigates James's theory and use of settings. His insistence that a character is "nothing without a setting" and his assertion that every character has a shell—a "whole envelope of circumstances" which overflows from a character and then flows back again—directs and defines the focus of the present study. A tabulation of the settings in his major novels and short stories is included in an appendix.

The investigation revealed that James's use of setting was primarily influenced by Balzac, Hawthorne and Taine. From Balzac James gained an admiration for (1) "solidity of specification"; (2) the use of details to extend the meaning of his material and (3) the fusion of all details so that the novel appeared as an organic whole. Taine suggested that copious details were necessary to indicate the character's race, place and time. Hawthorne's adroit artistry and avoidance of catalogues (1) increased James's interest in shadings and suggestiveness and (2) led James to supplement setting with inward psychological tensions.

James's theory of setting divided itself into a concern for the "stage" and a concern for "character." Since setting as "stage" tended to hamper James's psychological interest and prevent the proper fusion of setting and theme, he developed a close relation between place and character, so that setting provided (1) a means for developing the original concept of a character; (2) a means of "leading up" to a character and establishing a medium; and (3) a device for revealing a character and his tastes.

Two general applications of James's theories may be distinguished. Architectural settings are used for:
(1) backgrounds, (2) definition and communication of character, (3) parallels to theme and situation (as in Isabel Archer's ruined happiness paralleled by ruins of Rome),
(4) symbols and (5) representation of the influence of the past. Contrasting interiors and exteriors emphasize these uses of architectural setting. Larger settings involve the international scene where setting becomes an index of American and European sensibilities. The associations frequently overlap, but roughly speaking England may be taken as representative of a concern for the past, France as a place of freedom where choice becomes morally significant, and Italy as the epitome of the picturesque.

The study has particular value in the light of the controversy which exists between those who support James as an analyst of the international situation and those who insist that international differences are merely adventitious

particulars for the probing of the human psyche. On the basis of the whole study it is concluded that James was interested in both tasks. On the one hand, his rejection of the Picturesque as a proper end of fiction and his criticism of Balzac's enthusiasm for the villes de province reveal a critic focused on elements far beyond mere place. Moreover, analysis of his use of buildings and other architectural settings suggests his desire to use settings as a dynamic and suggestive aspect of fiction beyond its designation as "stage." On the other hand, James's love of England, France and Italy bespeaks an interest beyond that of the purely psychological novelist. One may conclude, therefore, that just as Hawthorne's influence on James tended to mitigate the influence of Balzac and Taine, so James's settings, in addition to providing overtones and elucidating character, tempered, embellished and illuminated his chosen psychological Microfilm \$3.80; Xerox \$13.00. 296 pages. themes.

A COMPARATIVE EVALUATION OF THE PASTORAL TRADITION IN ENGLISH AND FRENCH LITERATURE IN THE EARLY SEVENTEENTH CENTURY.

(L. C. Card No. Mic 59-3317)

Gerald Cohen, Ph.D. University of Washington, 1959

Chairman: Frank W. Jones

This dissertation discusses the pastoral element in three genres--- romance, tragicomedy and masque--- as it appears in representative writers of the Renaissance period in England and France. The chief authors discussed are William Browne, John Fletcher, Ben Johnson, Milton, Molière, d'Urfé, Racan and J. A. de Baif.

The thesis has two aims: to contribute to the history of genres, by showing the degree to which these writers were able to adapt pastoral traditions to the current stage of development of the genres within which they worked; and to compare the artistic merit of French and English endeavors in pastoral in the early seventeenth century.

The first aim entails the use of such terms as 'lyric' and 'lyrical' to describe the association of pastoral language with conventional Greek carpe diem imagery. This study extends these visions of momentary pleasure and innocence to a view of their use in three genres in combination with more realistic experience. There are times in a literary work when that experience is not literary (familiar rhetically), or conventional, itself. The action thus presented may be described as non-pastoral; it is usually courtly. On the other hand, the literary element is 'lyrical' in the sense of being 'poetic,' whereby the central subject of the work is pictorial, emblematical

or metaphorical. This figurative language identifies nature closely with man in a strong mutual portrayal of man's feelings and of his intense emotional reactions to rural life. Some of the pictorial images describe animals, usually sheep, who are attended by a pastor. Lyric poetry also has an association with dreams and visions; these help to create the aesthetic distance characteristic of pastoral landscapes and symbolic levels of love.

In the contexts of romance, tragicomedy and masque genres, the more 'realistic' effects are not essentially part of the pastoral tradition. There are episodes in pastoral literature that often differ in their effects of immediacy from the fantasies presented by conventional idyllic rituals. This can be seen in the very plausible responses of pastoral characters to their immediate situations. They are flesh and blood figures who suffer and exult in the obstacles imposed upon their romantic love.

The section titled "Pastoral and Romance" treats this juxtaposition of the real and the ideal; not their contrasting qualities. We can understand the combined use of 'reality' and 'romance' if we consider that figurative language can give the impression of both plausible and make-believe action. Pastoral descriptions often consist of observable details which give an impression of fidelity to experience. They can also fulfill certain dimensions of romance where things are as we should like them to be --in the believable play of make-believe. For example, a highly symbolical art form such as the masque owes its effectiveness both to literary metaphor and to courtly compliments of a social nature. Their combination tells us much about the adaptability of pastoral to its respective genre.

The second aim attempts to discriminate between the combined treatments of pastoral and realism in literatures that have developed differently. For example, with the prominence of the dance, the 'inner' literary content of masques became less important in French literature. On the other hand, the pastoral tradition was best represented by more poetic demonstrations of a full exploitation of pastoral decorum.

Two main conclusions are reached: that pastoral, though it has its own realistic conventions, can also be adapted to more prosaic norms; and that French literature achieved greater success in the narrative romance during this period, while English literature was more distinguished in the two dramatic forms discussed.

Microfilm \$2.80; Xerox \$9.60. 214 pages.

THE ATTIC.

(L. C. Card No. Mic 59-3789)

Henri Coulette, Ph.D.
State University of Iowa, 1959

Chairman: Professor Paul Engle

The Attic is a collection of twenty original poems and four translations. The poems are in a variety of traditional meters; the translations are from Catullus, Horace, and Jose Maria Heredia.

Microfilm \$2.00; Xerox \$3.00. 50 pages.

MASSINGER'S IMAGERY.

(L. C. Card No. Mic 59-3794)

Francis D. Evenhuis, Ph.D. State University of Iowa, 1959

Chairman: Professor Baldwin Maxwell

In the first half of this practical criticism, H. W. Wells'

Poetic Imagery supplies the typology used as a vehicle for comparing Massinger's imagery with that of various Elizabethan poets. This approach involves a functional study of Massinger's images in their context. The second half classifies the subject matter of Massinger's imagery (Miss Spurgeon's method), and relates it to his artistry. These methods are used to evaluate Massinger's style.

Regarding Wells' typology, Massinger employs a worn "decorative" image, facilitating an easy, colorful play on the emotions. His "violent" images, more sophisticated than Kyd's, are both numerous and unreal. In his "intensive" images he uses broad rather than detailed strokes. His "exuberant" images, often very rational, lack Marlovian zest. Though not very imaginative, his "sunken" image effectively colors his rhetoric in the restrained situations of his plays. For Shakespeare's "expansive" imagery he substitutes phrases of large, contrasting strokes. He employs "radical" images in the many satirical lines of his plays, but produces no wit. In the "humorous" type of image he exploits the Gothic. Frequently he uses these types of imagery self-consciously in forms of rhetorical contrivances.

Of the seven categories of the subject matter of his imagery, "Learning" contains 22.34 per cent of the total; "Daily Life," 22.23; "Nature," 18.54; "Animals," 15.21; "Body," 9.82; "Domestic," 9.08; "Arts," 2.68. Among the sub-divisions of these categories, "classical mythology and history" is the largest and shows the strong Ovidian influence in his plays. Statistics of Marlowe's and Shakespeare's categories of subject matter are placed in the chart beside those of Massinger. A discussion of Marlowe, Shakespeare, and Massinger enters into what subjects they chose and how they used these subjects in their imagery.

The study shows how Massinger often repeats both himself and other writers. He exploits conventional imagery in a business-like manner, adapting to Fletcher's sensational play on the emotions. Large, impressive subjects prevail in his tropes. His verse is oratorical, often stilted and bombastic. Yet, typical of his style are images so economically woven into his lines that he approaches a lucid though elaborate prose of rapid pace. Though adaptable to situations of calm and meditation, it is characterized mainly by a picturesque forcefulness. Since he stresses action and fails in characterization, his rhetoric is melodramatic.

eatly overlap, but roughly speaking England may be

Microfilm \$2.55; Xerox \$9.00. 198 pages.

PROSE STYLES IN THE ESSAYS OF E. B. WHITE.

(L. C. Card No. Mic 59-3323)

John Wesley Fuller, Ph.D. University of Washington, 1959

Chairman: Porter G. Perrin

The objective of this thesis is to identify and analyze both pervasive traits of prose style and differing styles in the essays of E. B. White. The thesis aims to focus attention primarily on the prose itself rather than upon the personality of the man or upon his development as an essayist, although a preliminary survey of those matters and an outline of his major themes are given in the first chapter to provide a needed context for the analyses that follow.

One of the central arguments of the thesis is that the typical essays found in each of White's first three collections of factual prose, Every Day is Saturday (1934), One Man's Meat (1942 and 1944), and The Wild Flag (1946), illustrate fairly distinct sub-styles. In addition to the three main sub-styles, several varieties of special stylistic adaptations are illustrated in essays that present some special attitude or point of view.

The most pervasive quality of White's style is its informality, and this quality is a stylistic implementation of his major themes and central attitudes—his satirization of the pretentious and artificial, and his defense of the simple and natural.

The most important pervasive traits of style are these:

- 1. A free use of informal diction and conversational idiom whatever the topic of an essay may be
- 2. Variations in sentence qualities that show demonstrable relationships to shifts in mood and idea
- Sentence rhythms that are, for the most part, like those
  of ordinary American prose, but occasionally heightened
  by the use of repeated intonation patterns
- 4. A high proportion of sentences that include interrupting elements, and a high proportion that are loose rather than periodic, having some bonus element added after the main clause is complete
- 5. A high proportion of sentences beginning with the subject of a main clause; a high proportion of compound-complex sentences; a slightly low proportion of complex sentences; and a slightly low proportion with adverbial beginnings
- 6. The regular use of special kinds of images that involve slightly comic juxtapositions
- The use in the essays of organizational structures that seem to be casual and rambling, but that are actually well-unified and esthetically pleasing.

Microfilm \$2.80; Xerox \$9.80. 216 pages.

# SHAKESPEARE'S GARTER PLAY: THE MERRY WIVES OF WINDSOR.

(L. C. Card No. Mic 59-3104)

William Green, Ph.D. Columbia University, 1959

The Merry Wives of Windsor is the sole drama of contemporary life that Shakespeare wrote. It contains a set of characters also found in 1 and 2 Henry IV and Henry V but who have no biographical links to their namesakes in these history plays. Attached to its main plot is the strange, unintegrated horse-stealing subplot with its never-appearing Duke de Jarmany. Running through the play are allusions to the Order of the Garter. The setting for all this is Windsor.

This seeming jumble of elements, however, does make a coherent design if we view the play as having been especially composed in a short period of time for performance at Whitehall before Queen Elizabeth and the Knights of the Garter on April 23, 1597. From this view, it is probable that George Carey, Lord Hunsdon commissioned Shakespeare to write the work for production at Court on St. George's Day in response to the Queen's wish -- long recorded in a stage tradition -- to see Falstaff in love. Hunsdon would have had good reason for taking such action, for on April 17 and 23 respectively he had been made Lord Chamberlain and a Knight of the Garter. He therefore may have gratified the Queen's wish in order to show his appreciation for these appointments. In working out Hunsdon's commission, Shakespeare set the play in contemporary Windsor at the time of some "grand affair" at the castle -- an affair which has to be a Garter installation. In this manner he pointed up the coming installation of his own patron, which Shakespeare knew would take place about a month after the April 23 election. Thus the dramatist was able to interweave his Falstaff-in-love plot with a tribute to both Lord Hunsdon and the Order of the Garter.

In developing the above proposition -- a portion of which stems from a theory of dating originally propounded but never fully investigated by Leslie Hotson -- I first present an account of the elements in the script which fix the play as a Garter play. Then I establish the historical background to support my thesis.

A study of the Order of the Garter procedures and ceremonies indicates that in the period 1593-1602 the only probable occasion for a performance of the Merry Wives at a Garter Feast was during the 1597 solemnities at Whitehall. References in contemporary documents, furthermore, reveal that Lord Hunsdon had sufficient foreknowledge of his new honors at that time to commission Shakespeare to write the play, and that Hunsdon was in a position to arrange for a special Court production.

Following this investigation of historical evidence, I turn to a study of text, discussing chiefly the relationship of the Quarto and Folio versions to one another. Matters of topical significance -- the Brooke-Broome variant reading, the identity of the Duke de Jarmany, and the horse-stealing subplot -- receive detailed investigation.

In the latter portions of my dissertation, I place the Merry Wives in the contemporary literary setting from which it emerged; that is, I discuss it in terms of other relevant plays in Shakespeare's canon and in relation to dramatic modes of the day to show that there is nothing

incompatible between Shakespeare's dramatic output as a whole and a 1597 date for the comedy. Lastly, I attempt a hypothetical reconstruction of the manner in which Shakespeare wrote the play.

The evidence offered throughout this dissertation is circumstantial. To me it points in one direction: the Merry Wives is Shakespeare's Garter play and would have been taken as such by the Elizabethans. Thus the play stands as vivid testimony to Shakespeare's ability to write on command, with little time, and for a specific occasion.

Microfilm \$3.65; Xerox \$12.40. 282 pages.

FUNCTIONAL PARADOX IN SIDNEY'S REVISED ARCADIA.

(L. C. Card No. Mic 59-3545)

George Walter Hallam, Jr., Ph.D. The University of Florida, 1959

Nearly all recent studies of Sidney's revised Arcadia reaffirm an interpretation established during a period of scholarship from 1907 to about 1935. At the heart of this interpretation is the contention that the revised Arcadia is an heroic poem or a Renaissance ideal of the epic. Though justly ascribing to Sidney's work a greater seriousness in conception and design than eighteenth- or nineteenth-century critics would allow, the interpretation tends, on the one hand, to augment rather than to reduce the apparent prolixity and incoherence which formed the basis for much earlier criticism of the romance and, on the other, to deny that the romance may be read as a unified whole with some simplicity of purpose operating beneath its outward complexity. If reconsidered in light of paradoxes of situation functioning conceptually in accordance with certain principles of Ramistic logic, however, the revised Arcadia is seen to have a unity that derives from an interrelationship of theme, structure, plot and style.

It can be demonstrated, by disentangling the narrative as though Sidney had presented it ab ovo instead of in medias res, that the revised Arcadia contains a basic plan of thematic development in which the parts contribute to the whole. Taking as his central, or general, theme the conventional paradox that adversity best discovers virtue, Sidney proves (i.e., illustrates) it, according to the Ramistic method for examples, by subjecting his heroes to paradoxes of situation, or specials, constructed from Ramus's places in logic and presented in each book with varying degrees of complication, interest, and artistic effect. As he develops his central theme, Sidney imparts increasing subtlety and ingenuity to the paradoxes of situation, amplifies them by other types of paradox, and allows them to be part of the larger paradox of violence and discord in the midst of an Arcadian setting. Hence the true foundation of his work: the discrepancy between things as they seem and things as they are.

The basic plan for unity just adumbrated is Ramus's natural method, which he prescribes for a learned audience. That this basic plan is not readily apparent in the revised Arcadia is due to the fact that Sidney's central purpose is to teach delightfully the exercise of virtuous action to a popular reader. He therefore deliberately

obscures, at Ramus's suggestion, the basic plan by using the prudential method, a fully defined statement of the classical in medias res structure in which rhetoric and logic work together to achieve the end of delightful instruction.

As corollaries to a reading of the revised Arcadia as a unified whole, based upon Sidney's application of certain Ramistic principles of investigation and method to paradox, the romance is seen to be meaningful at four levels: 1) it assumes a practical character by employing the spirit of Ramism to validate Sidney's theory as to the end of poetry, which is to teach and delight; 2) it assumes an historical importance by illustrating, creatively, the influence of Ramus's contention that the art of logic is to reason well; 3) it assumes a literary distinction by making a contribution to the development of prose fiction; and 4) it assumes an ontological significance by divulging a truth, as the poet Sidney sees it, about the nature of reality.

Sidney's revised Arcadia makes multiple claims for classification: it is at once an heroic romance, a practical guide to the exercise of virtuous action, an illustration of Ramistic logic, and a representation, in a unique sense, of the literature of paradox.

Microfilm \$3.45; Xerox \$11.80. 266 pages.

THE FAIREST MEED: BIOGRAPHY IN AMERICA BEFORE 1865.

(L. C. Card No. Mic 59-3107)

Stephen Jerome Haselton, Ph.D. Columbia University, 1959

The Fairest Meed is based principally on a study of some three hundred biographies, cognate forms such as eulogies and autobiographies, and periodical criticism. Its objectives are three: to describe theories and methods; to show how the art and heroes of biography were shaped by popular ideas, values, and enthusiasms; and to discuss trends that led to modern conceptions of life-writing.

Clergymen, America's first, most prolific, and most influential biographers, thought of their books as partial fulfillments of religious duties requiring them to commemorate Christian heroes and to expand God's kingdom. These goals, they believed, could be best achieved by portraying subjects as perfect, by identifying them with a preconceived ideal — the model minister of Christ. The characters of all these heroes therefore were remarkably similar. And their careers, too, were much the same, consisting only of stereotyped religious and official experiences. Each generation of writers, however, did modify interpretations and shift emphasis somewhat to suit changing values and interests.

National biography -- lives of statesmen, soldiers, businessmen, and pioneers written to subserve the cause of patriotism -- was but Christian biography in another garb. Its practioners did not try to recreate individuals, but sought to glorify America, to commemorate worthies, and to provide the nation with heroes who would represent its experiences and cherished ideals. Biographers made George Washington into a symbol of winning independence, and endowed him with all the virtues of Plutarch's men. The archetypal patriot, authors described other Cincinnati

in his image. Filiopietists turned Benjamin Franklin into a symbol of the nation's enterprise in trade and into a prototypal businessman whose acquisitive virtues inspired the portraits of other heroes who won wealth. The work of this school also helped to make Daniel Boone the emblem of winning the West and a hero whose natural virtues became standard descriptions of frontier figures that were to come.

Even at its apogee this type of life-writing began to meet opposition. Around the 1840s advocates of the same scholarly spirit found in much of the biography of eighteenth-century England made themselves heard. Although Jared Sparks ultimately handled his subjects with discreetness, he undertook extensive research, which inspired other writers and helped prepare the way for the successes of James Parton and Henry Randall in amassing facts and achieving accuracy. Panegyric was also counteracted by the century-old criticism of Samuel Johnson and the later art of James Boswell. His Johnson, slowly winning popularity in America, greatly helped to outmode the traditional craft of praise and to teach writers how to create illusions of actuality. At the mid-century a significant number of authors were portraying subjects less as stereotyped ideals and more as human beings and individuals.

Romanticism, too, winning importance in the 1830s, influenced biography. Its emphasis on individualism and the worth of all men gave lives a democratic flavor; its sense of wonder and the colorful past brought romance and adventure but blurred lines between truth and fiction; its stressing of emotion helped give biography a strong dose of sentimentality, and its renewal of the spirit of reform put biography to work in popular causes. But these changes only made the form a mirror of the times. More important to the changing art were romantic concepts of dynamism, wholeness, and uniqueness; these demanded that writers portray character in change, present all aspects of life, and give subjects dimension in depth. Yet, regrettably, authors made few of the methodological developments needed to present these ideas in a convincing manner.

Microfilm \$5.20; Xerox \$18.40. 407 pages.

A STUDY OF VISUALIZED DETAIL IN THE POETRY OF TENNYSON, ROSSETTI AND MORRIS.

(L. C. Card No. Mic 59-3258)

Stephen Evangelist Henderson, Ph.D. The University of Wisconsin, 1959

Supervisor: Associate Professor Alvin Whitley

It is the rare critic of Tennyson or the Pre-Raphaelite poets who fails to comment on the exactness or the decorative richness of their visual imagery or its relationship to painting. Such statements, however, are so general or cursory as to be virtually useless as criticism. This study aims, then, at ordering the visual details of the poetry so as to indicate their character, the ends they serve, and the basic similarities and differences between Tennyson, Rossetti, and Morris in this aspect of their craft.

Throughout the study the term "image" is taken to mean simply picture, whether it is a figure of speech or not, and "detail," any finer or minuter aspect of such a picture. The analysis is representative in the case of Morris but covers the entire range of the original poetry of Tennyson and Rossetti. In general, the emphasis is upon the text rather than criticism, though important critical works are considered.

The study shows that Tennyson's light is more farranging and subtle than that of Rossetti and Morris. Tennyson's colors, too, have a greater pictorial range than the bold, bright patterns of Morris and the more restrained usage of Rossetti.

Formerly, Tennyson's natural imagery has been studied for its scientific accuracy, but the question of his skill as a landscapist is just as important. Compared to Morris, an excellent landscapist, Tennyson shows great skill in painterly considerations.

When describing settings and objects made by man, the poets are usually distinct. Tennyson is attracted to the distant pattern of a city or some special feature like towers which are extensions of the recurrent image of the mountain. In contrast, Rossetti gives the close view of the city and the impression of individual buildings. His chief emphasis, however, is the room, which forms a basic image in his thought, and the total evidence suggests that the title of his greatest work, The House of Life, had its origins deep in his psyche. In addition, he and Morris are more interested than Tennyson in the suggestion of interior space.

In characterization, the most striking feature of Tennyson is his concern with accidents of gesture and appearance. Distinctive, too, are his means of idealizing the person and his relative lack of interest in contemporary dress. After the early poetry, Rossetti and Morris tend to generalize their characters, and though they avoid the genre tradition of Tennyson they have visual conventions of their own. The later Morris turns to formulas, and his young characters become almost interchangeable. Nevertheless, of the three, Morris shows most painterly interest in the human form.

When dealing directly with abstract ideas, Tennyson and Rossetti show a preference for personification.

Tennyson's figures, however, have greater variety of form and conception. In simile and metaphor Rossetti's distinctive themes and Tennyson's concern with natural imagery appear. The purely imaginative creations fall into two groups, the anthropomorphic and the non-anthropomorphic, and in all three poets reveal a tendency toward the morbid which colors other aspects of the imagery as well.

Tennyson's poetry can be profitably studied in relation to the contemporary graphic arts. The Moxon Tennyson is important not only for the Pre-Raphaelite illustrations but also for the genre designs which imply a convention of representation in which pictures from other sources could easily illustrate Tennyson. Moreover, the themes of these works are paralleled in Tennyson's domestic idylls. Finally, just as English impressionism in painting anticipated Impressionism in France, so the poetry of Tennyson with its emphasis on fleeting appearances and the dynamic aspect of light anticipated the poetry of the Aesthetes which consciously followed the theories of Impressionism.

Microfilm \$4.90; Xerox \$16.40. 383 pages.

THE WAR AGAINST WAR IN THE NINETEENTH CENTURY: A STUDY OF THE WESTERN BACKGROUNDS OF GANDHIAN THOUGHT.

(L. C. Card No. Mic 59-3109)

Harrison Hoblitzelle, Ph.D. Columbia University, 1959

Mahatma Gandhi acknowledged that the spark of his inspiration came largely from the words of certain Western prophets of the nineteenth century. He said that Ruskin (in Unto This Last) and Tolstoy (in The Kingdom of God is Within You) had revolutionized his life; and he expressed profound indebtedness to Emerson and Thoreau. From these writers he received both the impetus for his own personal growth and the inspiration to forge the instrument of non-violent direct action. This study reviews the development of the men and ideas that influenced Gandhi and then seeks to evaluate Gandhi's own accomplishment.

Seen through Gandhi's eyes, these literary figures and their inter-relationships take on a new significance. During the nineteenth century, a period when the problem of war was studied as never before, two schools of thought developed which, though independently they came to nothing, laid the groundwork for the achievement of Gandhi. On the one hand there was the philosophy of non-resistance, advocated by the Anglo-American peace crusade and summed up by Tolstoy, and on the other, the idea, advanced by Carlyle, Ruskin, Emerson and William James, of a moral equivalent of war. Gandhi, by a disciplined combination of these two elements, was able to bring into being the non-violent resistance of Satyagraha, the political as well as moral equivalent of war.

Carlyle and his disciples saw the folly of military pride and proposed to their age a new chivalry of labor. Emerson pointed to the "higher heroism" of non-violence; Ruskin, in proposing "soldiers of the plowshare," broadened the international implications of the new chivalry as the basis for a creative peace. Tolstoy added his comprehensive doctrine calling for unconditional rejection of violence at all levels. These were the men who changed Gandhi's life and these the ideas he put to the test in what he called his "experiments with truth."

In considering Gandhi's roots one must beware of underestimating the formative influence of his native culture, yet the fact remains that the light of the East often came to him through Western windows. Tolstoy and Thoreau, for example, were proficient in Sanscrit and steeped in the religious philosophy of the orient. Indeed, Gandhi's objections to Western culture were derived in large measure from the attacks of Western critics.

The final aim of this study is to shed further light upon Gandhi's achievement and its significance to the West. It stops short of the inevitable question of whether non-violent methods are relevant in the world of today, but suggests in conclusion that in a wider understanding of what Gandhi stood for, lie the seeds of future hope.

Microfilm \$2.75; Xerox \$9.40. 210 pages.

IMAGE AND SYMBOL IN THE POETRY AND PROSE OF DANTE GABRIEL ROSSETTI.

(L. C. Card No. Mic 59-2531)

Stanley Marquis Holberg, Ph.D. University of Maryland, 1958

Supervisor: Franklin D. Cooley

This study is an examination of the poetry and prose of Dante Gabriel Rossetti to explore his Symbolic method of expression. Although known as the leader of the Aesthetic Movement, he can rightly be called an English Symbolist, for Aestheticism, as practiced by him, grew out of the same motive as that which informed the works of the French Symbolists: to create a means of expression that would make possible the communication of personal states of feeling in all their original intensity and their individual, evanescent, subtle qualities. Although his poetic practices differed considerably from those of the French Symbolists, like them he realized that it is the poetry of suggestion, not of statement, through which this aim can be realized.

Rossetti's system of Symbolic expression called for the creation of a literature of dream—a literature that exploits the proposition that intense feeling has the power to abstract the mind in some degree from its normal conscious activities. Accordingly, the particular flavor of his writing derives from the fact that it seems continually to give expression to the mind thus abstracted under the power of heightened feeling.

Even his paintings show the central position of the dream in his creative imagination. The dramatic scenes that dominated his productions in the earlier years as well as the single female figures that come somewhat later are steeped in an atmosphere of dream. The central figures themselves are normally lost in the contemplation of their own inner worlds, and they are presented against preternaturally clear and intense backgrounds more in keeping with the perceptions of dreaming than waking. They seem somehow to be isolated from the affairs of the workaday world. Such elements as these occur with different degrees of emphasis at different times, but the effect of these paintings, which seem to exist on their own plane of reality, is the suggestion of hidden meanings that lie beyond the apprehension of conscious thought.

The Symbolic use of elements of dream to suggest states of feeling is observable throughout the writings. Sometimes a particular part of a work, sometimes the whole piece, seems to have been summoned up by the dreaming mind, erupting, as it were, onto the surface of life, bodying forth the contents of the inner life. Principally through the choice and disposition of imagery, the poet--either as narrator or lyricist--takes on the posture of a central figure in a Rossetti painting: isolated from external reality, completely absorbed in the inner world. The imagery thus involved varies greatly, and although it is difficult to define any course of development in Rossetti's style with certainty, a broad distinction can be drawn between his earlier habit of representing the dream state with irrelevant, clearly etched images that are seen with a clarity normally unknown to waking life and his later practice of using more relevant imagery to suggest not only the dream state but something about its contents as well.

A cursory view of Rossetti's life clearly suggests that the Symbolic literature of dream came naturally to him, for in life as well as in art his inner, unconscious self seems continually to have struggled for, and often gained, control over the pursuit of his conscious aims. These unconscious demands appear to have been organized around a necessity to withhold some part of himself from active participation in life. And that his was the authentic prose and poetry of dream can be seen in the frequent recurrence of certain kinds of images that bespeak the investment of a great deal of psychic energy in the contemplation of various aspects of the self.

Microfilm \$4.70; Xerox \$15.80. 366 pages.

THE UNITY OF MACBETH:
A STUDY OF THEMATIC IMAGERY.

(L. C. Card No. Mic 59-3040)

Helen Yvonne Hughes, Ph.D. University of Arkansas, 1959

Major Professor: Albert Howard Carter

The use of thematic imagery contributes to the extraordinary unity of Macbeth. Images repeated in action, characterization, and spectacle so often that they become thematic reveal the thought of the play. The themes thus unify the elements of the play-action, character, spectacle, thought, and diction. Most of the themes, such as blood, clothing, or sleep, are the subject matter of concrete images; others, such as trust, appearance and reality, or paradox, are abstract concepts expressed through concrete images.

Each theme contains smaller units of repeated images
--the bell imagery in the theme of death, for example-which add to the unity within themes. The repeated images
may have a symbolic function. Furthermore, the repetition
may have an effect on the subconscious mind analogous to
the effects of subliminal projection; consequently, they
heighten the emotional impact of the play.

Repetition is not the only structural use of the thematic images which adds to their unity. Other uses are fore-

shadowing, parallelism, irony, and contrast.

A major contribution to the unity of the play as a whole is the interrelationship of single themes. As two themes fuse, they may give an added dimension to the play by suggesting a new facet of the thought of the play, or an idea which otherwise would not be revealed.

Microfilm \$2.95; Xerox \$10.00. 225 pages.

THE FORTNIGHTLY REVIEW AND FRANCE: POLITICS AND LITERATURE, 1865-1882.

(L. C. Card No. Mic 59-2860)

Edward Lyons, Ph.D. Columbia University, 1959

This is a descriptive summary of the attitudes toward France expressed by the Fortnightly Review under its first

two editors. Anglo-French sympathies had been strained since the time of the French Revolution. The Fortnightly played a part in dissolving the attendant English insularity and cultural provincialism. Though it hoped at first to attract a variety of opinion, it soon became predominantly liberal, partly because Lewes was a liberal, partly because its liberal side repelled conservative writers.

Under G. H. Lewes, the Fortnightly expressed fear of Napoleon III as a scheming political absolutist with no redeeming qualities or accomplishments, who threatened the liberty and independence of all Europe. It worried about a possible Anglo-French alliance, darkly misread French finances, and made light of Germany's growing power. At the same time, it partly affirmed the English prejudice that the French were by nature unfitted for political freedom.

Under John Morley, the Fortnightly continued its hostility to Napoleon III. Though prophesying that war would not come, Morley protested against inadequate French attempts to prepare for it, but not against the more effective preparations made by Bismarck, or against Bismarck's suppression of civil liberties in Germany.

The Franco-Prussian war brought a sharp break between Morley and his old friend and contributor Frederic Harrison. Like all of England, the Fortnightly was caught napping by the outbreak of the war. Morley urged England to make armed intervention against France. He believed that Bismarck was working for European peace and welfare which a French victory would indefinitely doom. Yet he continued to publish Frederic Harrison's savage attacks on Bismarck. Harrison prophesied permanent despotism for Europe if Bismarck should prevail.

The Fortnightly discussed the poetry of Hugo, Baudelaire, Gautier, Musset, Laprade, and Guérin. Although English literature was often criticized on the basis of humanitarian and republican attitudes by the Fortnightly, French literature was more often evaluated aesthetically. Hugo was highly praised in some articles, but opinion of him ranged from the extravagant admiration of Swinburne to the view of Lewes that Hugo was guilty not only of turgid, meaningless language but also of inflated selfimportance, and even of having nothing to say. Morley agreed with Swinburne, though in a more temperate tone. Saintsbury was more objective than either Morley or Swinburne on the subject. Musset was considered unhealthy by one reviewer, and by another was disadvantageously compared with Tennyson. Baudelaire was applauded as an original genius who put art first.

Among the novelists, Rousseau, Hugo, Balzac, Sand, Flaubert, and Zola were appraised. Morley showed sympathetic insight into Rousseau, a man temperamentally distasteful to him. He thought that Julie, in La Nouvelle Héloise, served the cause of women's rights, but that the book was dangerous because it raised feeling above reason. Lewes again found Hugo indulging in bombast and nonsense at the expense of artistic craftsmanship, whereas Swinburne classed him with Aeschylus, Dante, and Shakespeare. Leslie Stephen acquitted Balzac of damaging immorality. While crediting Balzac with unique powers of portraying the darker truths of human nature, Stephen felt that he carried matters so far as to sacrifice credibility. Saintsbury's fulsome defense of Flaubert, though overlooking some of the novelist's meaning, placed a high value on the pleasure he imparted and on the perfection of his craftsmanship. The Fortnightly disposed of Zola's

claim to innovation in the novel genre, criticized his technical faults, and doubted the validity of determinism as a tool for creating or evaluating literature. In general its articles on France and French literature encouraged cultural freedom and variety.

Microfilm \$2.15; Xerox \$7.60. 164 pages.

BENOÎT DE MAILLET -- EIGHTEENTH-CENTURY NATURALIST (A STUDY OF TELLIAMED).

(L. C. Card No. Mic 59-3126)

Harriet Dorothy Rothschild, Ph.D. Columbia University, 1959

Benoît de Maillet (1656-1738) was a French diplomat in the consular service in Egypt and in the Mediterranean during the early years of the eighteenth century. He composed a theory of the universe, Telliamed, ou entretiens d'un philosophe indien avec un missionnaire françois, which he circulated in manuscript form.

In 1730, the Abbé Jean-Baptiste Le Mascrier became De Maillet's editor-correspondent. In 1735, the Abbé published De Maillet's earlier Description de l'Egypte. However, he delayed publication of Telliamed until ten years after the author's death.

The Abbé's printed editions of Telliamed represented altered versions of the manuscripts. Le Mascrier substituted six "journées" or days of conversation for the three "entretiens" or discourses of the original manuscripts, inserted a mock dedication to Cyrano de Bergerac and an apologetic preface for reasons of self-protection. The third French edition of 1755 contained supplementary material absent from the earlier texts and the manuscripts. The American edition lacked the dedication to Cyrano. This popular cosmogony was the subject of heated controversy in its day but vanished thereafter into literary obscurity.

Telliamed is a series of discourses taking place in Cairo between an Indian wiseman and a French missionary. The "philosophe" or wiseman is Telliamed, and Telliamed, in turn, is an anagram of the author's name, De Maillet. The first four "journées" concern the geological basis for Telliamed's theory of the earth; the fifth "journée" explains the astronomical basis of the system; and the sixth reveals the origin of life.

The Indian wiseman postulated his system of the universe in flux upon his inductive observations of the apparently diminishing sea: the watery globes and fiery suns of the macrocosm were posited upon the geological phenomena of the earth; the forces of the mighty oceans which sculptured the earth, also sustained life upon it. As the waters receded, life emerged, evolving from an aquatic to a terrestrial existence. Thus, the process of diminution continued concurrently with the evolution of organic and inorganic forms. In time, life would perish with the globe. The general conflagration of the desiccated earth would return the germs of life to the atmosphere, which would transport them to a renewed existence on other watery globes.

Telliamed expressly denied the universality of the Mosaic Deluge and estimated the age of the earth in terms of several hundred thousand years. His uniformitarian geology depended on recognition of fossils as once-living organisms and on his analysis of stratified sedimentary rock. According to his Cartesian astronomy, the earth was part of a solar vortex, of which there were countless numbers in space. The wiseman's evolutionary theory, which accepted mermen and mermaids as transitional forms of development, and tailed men as a racial subdivision of mankind, contradicted the Biblical dogma of instantaneous divine creation.

De Maillet's Telliamed was a serious exposition of natural science composed by a highly qualified amateur. The author's views on the origin and destiny of the earth depended on his own experimental research and on the philosophies of ancient and modern thinkers. He dared deny the taboos of tradition at a time when the rack and wheel still threatened the dissenter, and, consequently, helped stimulate popular interest in scientific inquiry.

De Maillet's value as an eighteenth-century writer of science fiction does not lie in his restatement of old ideas but in the fact that he wrote in French for the public at large, challenged doctrinaire authoritarianism, and helped pioneer modern evolutionary philosophy.

Microfilm \$2.05; Xerox \$7.40. 156 pages.

#### POEMS.

(L. C. Card No. Mic 59-3823)

John Alfred Taylor, Ph.D. State University of Iowa, 1959

Chairman: Professor Paul Engle

The dissertation consists of twenty-seven poems of varying form, subject, and length, and were written under the chairmanship of Professor Paul Engle.

Microfilm \$2.00; Xerox \$3.00. 54 pages.

# LANGUAGE AND LITERATURE, CLASSICAL

# THE LETTERS OF DEMOSTHENES.

(L. C. Card No. Mic 59-3103)

Jonathan A. Goldstein, Ph.D. Columbia University, 1959

The purpose of this study is to explain the nature and content of Demosthenes' Epistles 1-4 and reexamine the question of their authenticity, denied by many scholars since the eighteenth century. The letters purport to have been sent by Demosthenes to the Council and People of Athens in 323/2 B.C. In them, the orator, who fled from prison into exile after having been convicted of bribetaking in the "Harpalus affair," seeks to win vindication as well as to present to the Athenians his views on current issues.

In order to determine the date of the composition of the letters, first the evidence discoverable in the references

to them in ancient literature and in the peculiarities of the papyri and medieval manuscripts containing them is examined, and then that derivable from vocabulary and style. The evidence indicates that the letters, if not written by Demosthenes, were composed within a few decades of his death.

To determine whether Demosthenes himself wrote the letters, genres of fabrications known from the time of Demosthenes, or at least from the Hellenistic period, are considered. Criteria are suggested by which historical and rhetorical analysis can decide among the various alternatives.

Study of what can be learned of the historical events which the letters purport to reflect reveals the author's accurate knowledge of these events, and no demonstrable anachronisms. The documents form a sequence in which the developing situation of the period of Demosthenes' sojourn in exile seems to be reflected. Overtly or covertly, each letter has as its chief purpose the orator's return to Athens; each seems to reflect both the failure of the previous pleas and the changes in the Athenian political scene which occasioned the new one. The series of messages began with a letter now lost, of which, however, the content can be reconstructed. The next letter is Ep. 3, datable between Munichion (April) and the end of the ninth prytany (circa June 7), 323. Ep. 1 is last, mentioning the death of Alexander and reflecting the oncoming Hellenic revolt. Ep. 2 exhibits a stage certainly later than Ep. 3, probably after the end of the ninth prytany. The position of Ep. 4 is uncertain, but it surely is earlier than Ep. 1. This historical analysis suggests that the letters exhibit knowledge and interests which one would ascribe to Demosthenes rather than to a fabricator.

The question is next examined by rhetorical analysis. The letters are shown to belong to the ancient rhetorical genre of the "deliberative" speech (demegoria). Their subject, the attempt of a condemned criminal to seek restoration, makes them apologetic in tone, and any fabricator of the letters would indeed have cast them as apologies. Yet the normal form in antiquity for apology, real or fictitious, was the forensic speech. The demegoria was an awkward form for apology, yet the exiled Demosthenes would have had to use it. Analysis of the rhetorical organization of Epp. 1-4 shows that they are demegoriae, not forensic speeches. Comparison with an authentic Athenian apologetic demegoria, Andocides' De Reditu, and a known forgery, the Letters of Aeschines, confirms that the form and techniques of Epp. 1-4 are those which Demosthenes would have had to use and differ significantly from those which might have been used by an ancient fabricator.

Thus a strong presumption is established in favor of the authenticity of Epp. 1-3, and a good one in favor of that of Ep. 4. The dissertation also presents a new translation of the letters, which aims less at elegance than at accurately reflecting the meaning of the Greek, and a running commentary. Microfilm \$7.50; Xerox \$25.80. 591 pages.

# GIORDANO BRUNO'S THE HEROIC FRENZIES: A TRANSLATION WITH INTRODUCTION AND NOTES.

(L. C. Card No. Mic 59-3119)

Paul Eugene Memmo, Jr., Ph.D. Columbia University, 1959

The purpose of the introduction is to show the fundamental coherence underlying the emblems, sonnets and philosophical commentary of The Heroic Frenzies, and to indicate the origin of Bruno's emblems.

The cosmological and ethical works of Giordano Bruno written during the London period are discussed in their relation to The Heroic Frenzies. A brief analysis is made of the relevant works of Aristotle, Plotinus, Averroës, St. Thomas Aquinas, Nicolaus of Cusa and Marsilio Ficino and the relation of these writers is indicated to the theory of love developed in The Heroic Frenzies.

In a following section the lyrical tradition of Dante and Petrarch is surveyed with reference to Bruno's lyrical techniques. In the poetry of Dante and Petrarch the honored lady of the courtly tradition acquired new metaphysical and theological meaning and assumed the role of leading her lover to God through her wisdom, beauty and goodness. In an analogous manner, Bruno describes the progress of the lover from his first intuition of the beauty of the beloved to the ultimate attainment of the supreme beauty. In the meantime, the lover is described as alternating between progress and regression in his arduous journey toward the summum bonum and summum pulchrum.

Bruno's place in the European emblematic tradition is discussed in some detail. Emblems in the books of four contemporaries of Bruno are analyzed and are shown to compare closely to emblems in The Heroic Frenzies. The relation between sonnet and emblem as points of departure for Bruno's commentary is discussed.

In a final section of the introduction it is demonstrated that the emblems present a complete and independent allegory of the lover's story. Like the sonnets they reflect the lover's state as he moves through cycles of progression and regression before he finally achieves the <u>summum bonum on earth</u>.

The translation depends largely upon Gentile's text of 1927 and is intended to supersede the Williams translation of 1887. Microfilm \$5.65; Xerox \$19.80. 441 pages.

#### PLATO'S SYMBOLISM.

(L. C. Card No. Mic 59-3282)

Paul Christian Plass, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Paul L. MacKendrick

Because Plato's own introduction to philosophy was closely bound up with the vivid life of philosophic circles in Athens and with the personality of Socrates, and because the ultimate reality that philosophy seeks can be grasped only by an immediate, highly dramatic intuition, philosophy for Plato is not simply the use of discursive reason, but is also a dramatic event in which the philosopher

becomes emotionally involved. This concept of living philosophy posed a problem of communication. Plato met the problem with the dramatic dialogue, which as a form is itself an essential part of what he understands philosophy to be, since the dialogue seeks to re-create the emotional-intellectual involvement of philosophy by embedding ideas in a suitable dramatic context (setting, events, personalities, atmosphere, etc.). The complimentary relationship between the analysis of a certain idea and its dramatic context can be regarded as a type of symbolism; the context is dramatically symbolic of the idea.

Vivid dramatic experience thus becomes part of the substance of philosophy, and the interweaving of analysis with action and reaction is a basic part of the philosophic writer's craft. Some details of the interplay of idea and drama can be traced in various dialogues:

Euthyphro: Euthyphro's belief that he is similar to Socrates dramatizes the confusion of Socrates with men like Euthyphro which contributed to the popular misunderstanding of Socrates and symbolizes the uncertainty about the definition of holiness.

Phaedo: the emotional rhythm of sorrow and joy conditions the reader for Plato's largely mystic answer to the problem of death, and the paradoxically inconsistent emotions of those present reflect the tension resulting from Plato's uncertainty about his logical proofs for immortality.

Euthydemus, Protagoras, Gorgias: Plato emphasizes the difficulty of communication between Socrates and sophists to symbolize the incompatability in philosophic method; the causes of the breakdown of effective communication range from the sheer silliness of the sophists in the Euthydemus to the ill-will and sharp conflict in the Gorgias.

Symposium, Phaedrus: the setting and atmosphere of "unusualness" (atopia) symbolize the extraordinary philosophic ideas of inspiration and intuition; the highly specific erotic situations indicate that Plato's Eros itself includes a measure of conventional erotic experience.

The themes of old age and the passage of time are prominent in Plato's later dialogues through elderly characters and allusions to vast periods of time. This symbolizes the elderly Plato's resignation and detachment as well as the ultimate insignificance even of philosophic man relative to the universe.

Plato's dualism leads him to reduce many subjects to antitheses which ultimately mirror the universal antithesis of the One and the many. The terms of an antithesis may stand in opposite relationships; e.g., from Plato's point of view the philosopher is wise, the common man foolish; from the common point of view the opposite is true. The pattern of alternating positions of terms is inversion, which as a pattern is symbolic of the dualism and its implications that underlie Plato's thought.

The motif of deception is prominent because inversion leads to a widespread confusion of the proper relative values of antitheses; comedy and tragedy as seen by both philosopher and common man are a particular case of inversion. Inversion also leads to ambiguity in the meaning of terms, and Plato finds several philosophic ideas implicit in various meanings of "amusement" (paidia).

Microfilm \$3.00; Xerox \$10.20. 229 pages.

TIME PAST AND THE HERO: A SUGGESTED CRITERION FOR SOPHOCLEAN TRAGEDY AS EXEMPLIFIED BY THE AJAX, TRACHINIAE AND ELECTRA.

(L. C. Card No. Mic 59-3351)

Lawrence Theodore Wellein, Ph.D. University of Washington, 1959

Chairman: Frank W. Jones

The thesis of this dissertation is that in Ajax, Trachiniae and Electra Sophocles has deliberately depicted his protagonists as anachronisms. As viewed in these plays Sophoclean tragedy originates in the fact that the protagonist either has committed himself irrevocably to the past at the time the play begins or yields to the past under the stress of the events of the play.

Ajax is a man who lives and dies under the obsession of heroic arete. The word arete denotes a subjective quality, a man's awareness of his inherent worth, but the connotations of the word involve the relationship of man to the communal group. With the passing of time public evaluation of Ajax' worth has declined. But Ajax cannot accept the Greeks' rejection of him as fact; to do so would be to accept the Greeks' evaluation. Passive submission to their decision would have been tantamount to admitting that his arete was valueless. And so Ajax was compelled to seek vengeance, confusing in the process chieftains and beasts. Slaughtering the flocks actually emphasizes the futility of Ajax' act, for in moving against the Greek leaders Ajax had striven to turn the clock back. Moreover, it does not ultimately matter whether Ajax had killed animals or chieftains; in either instance Ajax' arete would have been ineradicably tainted by the nature of the act. But this awareness does not come to the hero; he expresses no remorse for the act itself but only for the failure of the act.

Because Ajax is quite evidently an anachronism, it might seem misleading to align Deianeira and Electra with him. Yet I believe that this alignment is a natural one and that it sheds considerable light on the Trachiniae and Electra. One characteristic which distinguishes the Trachiniae from Ajax is the equivocal nature of Deianeira's dialogue; the action of this play depends greatly on her covert responses to impinging circumstances. We are introduced to Deianeira before the full pressure of events is imposed upon her and we watch her as she first attempts to adapt herself to the inexorable change of situation and then, as that situation becomes all too clear, as she strives to keep it from coming about. Sophocles is a remarkably detached dramatist in this play, but he gives us some basis for skepticism of Deianeira in the care which he has taken to show how the past has affected her vision of the future. As the tragedy unfolds, we can see that she has outlived her time and that her expression of faith in the oracle (1. 168) takes on an ominous significance.

Electra is concerned with the dramatic depiction of the potential of dike; but the old life-for-a-life code wins out. It wins out because ultimately both Orestes and Electra turn back to its old way for the resolution of their problems and thereby place themselves in the traditionally vulnerable positions of the Pelopidae. The Electra who abhorred the nature of her mother takes to herself the

mother's sense of dike and in the process becomes the surrogate of Clytemnestra. Sophocles emphasizes this transformation by allowing Electra to confront Aegisthus; her insinuating tone and the scene itself calls back to our minds the crucial scene of Agamemnon, the electric moment when Clytemnestra welcomed her husband.

Microfilm \$2.15; Xerox \$7.60. 162 pages.

# LANGUAGE AND LITERATURE, LINGUISTICS

THE PRONOUN OF DIRECT ADDRESS IN SEVENTEENTH CENTURY ENGLISH.

(L. C. Card No. Mic 59-2851)

Anne Carvey Johnson, Ph.D. Columbia University, 1959

Entering the English language in the thirteenth century, you in the function of the singular had, by about 1600, taken the place of the historical singular form, thou, as the pronoun of address in polite usage. Gradually disappearing from use, thou had become obsolete in the standard language in the eighteenth century. In this survey, my aim has been to determine the relative frequencies of you and thou, the social use of these pronouns, and the occasions upon which thou might still be employed throughout the seventeenth century and during the years immediately

preceding and following it.

Modern scholarship has considered the use of the pronoun of address in the following detailed studies: Arthur Garfield Kennedy, The Pronoun of Address in English Literature of the Thirteenth Century (Stanford University, 1915); Russell Osborne Stidston, The Use of Ye in the Function of Thou in Middle English Literature from MS. Auchinleck to MS. Vernon; a Study of Grammar and Social Intercourse in Fourteenth Century England (Stanford University, 1917); and Sister St. Geraldine Byrne, Shakespeare's Use of the Pronoun of Address: Its Significance in Characterization and Motivation (Washington, 1936). Martin Bock, in Der stilistische Gebrauch des englischen Personalpronomens der 2. Person im volkstümlichen Dialog der alteren englischen Komödie (unpublished dissertation, Innsbruck, 1938), has provided a survey of the use of you and thou in English comedy from about 1500 to about 1775.

I have counted the occurrences of these pronouns in thirty comedies and, as a supplement, in twelve works of popular fiction of the seventeenth century and in one comedy of each of the years 1599, 1700, and 1701 and in one work of fiction of each of the years 1597 and 1711-1712. A wide range of social types is represented in these texts, and colloquial dialogue is generally used. Except for the middle years of the century, when the production of literature was interrupted by the Civil War, the works are fairly evenly distributed over the period. I have described briefly the occasions for the use, in each text, of you and thou and have analyzed in much greater detail both the forms and uses of these pronouns in three of the comedies studied, Thomas Dekker's The Shoemakers'

Holiday (1599), Thomas Shadwell's The Squire of Alsatia (1688), and William Congreve's Love for Love (1695).

The members of the three classes of society, upper, middle, and lower, whether speaking among themselves or to one another, commonly use you. Thou, especially early in the century, is frequently employed by a superior to an inferior, between equals, within the family (especially by the older members to the younger), in contempt, in irony, in soliloquy, in the address of supernatural beings, and in moments of intimacy and stress. You, however, if the speaker so desires, may be properly employed upon any of these occasions.

Quantitatively, the use of you and thou is extremely irregular and leads to the conclusion that the distinction between the two pronouns is meaningless. And so erratic is the data that I find it impossible to assign a date to the decline of thou. However, a general decrease in its percentage of occurrence seems apparent in the second half of the century; before 1650, thou appears at the rate of 25.18% and after that date, at the rate of 16.34%.

Tables showing the number of occurrences and the relative frequencies of you and thou in each text and in each social class are provided in appendices.

Microfilm \$3.60; Xerox \$12.20. 279 pages.

AN ANALYSIS OF THE PHONEMES OF ENGLISH SPEECH WITH INSTRUCTIONAL MATERIALS FOR TEACHING THEM TO NON-ENGLISH-SPEAKING PERSONS.

(L. C. Card No. Mic 59-1367)

George H. Owen, Ed.D. Wayne State University, 1958

Please see abstract on page 970.
Microfilm \$4.55; Xerox \$15.40. 356 pages.

### LANGUAGE AND LITERATURE, MODERN

THE RHYMERS' CLUB.

(L. C. Card No. Mic 59-3087)

Karl E. Beckson, Ph.D. Columbia University, 1959

In the early months of 1891, a number of young poets met in Fitzroy Street, London, in the rooms of the Century Guild, an organization of artists, to read and comment on their verse. Avoiding association with other groups, they called themselves simply the "Rhymers' Club." Believing that poetry was superior to science, tending to identify "beauty" with delicacy, fragility, mystery, and forbidden fruits, the Rhymers felt that the artist was being displaced from a world that was surrendering itself to the unimaginative bourgeoisie. Bourgeois themselves, the Rhymers disliked what they saw, for man's creative spirit was capable of better things than the ugliness of machines and

factories. Only through art, they felt, could man revitalize his imagination.

Believing in the importance of craft, an idea inherited from French and English Parnassianism, they concentrated on small forms; they were little interested, however, in fixed forms. Their verse, with its traditional rhyme schemes and conventional stanzas, is filled with the worn-out diction of much nineteenth-century verse. Indeed, the traditionalism of their poetry is perhaps more striking than their presumed avantgarde concern with "purity." The idea of l'art pour l'art, held by Symons and several other Rhymers, was an expression of the desire for freedom in subject matter, for many aesthetes were attempting to extend their sensibilities in verse without regard for morality or conventional decency.

Fascinated by artifice in verse, Arthur Symons, Richard Le Gallienne, Victor Plarr, and Lionel Johnson wrote poems containing lapidary images designed to produce the appearance of hard, clear lines. From Baudelaire, they were inspired to turn to the city for new and strange imagery, and from Huysmans A Rebours they adopted an attitude of curiosity toward the natural, for in artifice lay the source of exotic and interesting experiences which nature could not provide.

The decadents in the Rhymers' Club--notably Symons, G. A. Greene, Le Gallienne, Ernest Dowson, and Johnson --affected various poses as part of their theatricalism in verse. Writing of femme fatales, of extraordinary weariness, of despair and the desire for oblivion, they provided their readers and themselves with spectacles of the poet's uniqueness in a society enslaved by commercialism and bourgeois ideas of progress. The poet's unconventional verse thus functioned as artistic protest against the drabness of the nineteenth-century world of machinery.

In 1894, the year of the Rhymers' second anthology (the first had been published in 1892), the decline in Dowson's health and the psychological deterioration of Johnson forced both to withdraw from their friends at the Cheshire Cheese, where the Club usually met. Though these occurrences contributed to the break-up of the Club, perhaps the most important factor which brought about its dissolution was the defection of the Celtic members to the London Irish Literary Society, which Yeats had founded in 1891 as part of the Irish literary revival of the nineties. By 1894, eight of the fourteen members of the Club had decided to devote their energies to the nationalistic movement which promised to restore Ireland's cultural position.

Without a common ideal or a unifying purpose, the Rhymers' Club could not survive the divisions of interest which beset it. With no formal organization to give direction to its meetings, the Club was incapable of providing continuity during periods when there were few members in London. Consequently, after the publication of the second anthology in 1894, the Rhymers Club dissolved as a result of weakened interest and redirected energies.

W. B. Yeats, who with Ernest Rhys and T. W. Rollestion had founded the Club, envisioned the Rhymers as part of what he called "the tragic generation." In the deaths of Dowson, Johnson, and Davidson, he saw a kind of martyrdom in the cause of art, a sacrifice of life in the quest for beauty. By making poetry their central concern, the Rhymers affirmed the belief that the aesthetic movement, which came to a close in the late nineteenth

century, was the great yea-sayer to beauty. Their lives were testaments to that faith.

Microfilm \$2.70; Xerox \$9.40. 206 pages.

### HERMAN MELVILLE: NIHILIST.

(L. C. Card No. Mic 59-3240)

Jack Jay Boies, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Henry A. Pochmann

Herman Melville, in striking contrast to his philosophically optimistic contemporaries Emerson and Whitman, represents one of the most profound examples of negativity in American letters. He is what I should like to call a "nihilist," a man who believes in nothing, or -- as a leading existentialist defines the word -- a "disillusioned, serious man," the sort who yearns for a God, a cause, a system, or a self to believe in, but who, because he has been disillusioned, turns his desire into destructivity.

This pattern of negativity in Melville's personality evinced itself in his works in three distinct manners: personal, metaphysical, and social. Melville was despairingly negative with regard to himself, to the cosmos, and to his fellow man, and my study attempts to produce evidence of this three-fold negativity in Melville's life and works.

According to M. Albert Camus, the first great philosophical question that a man must face is whether or not to live in the world, whether "to be or not to be," whether or not to commit suicide. Melville personally decided that life was scarcely worth the pain of living, but instead of choosing physical annihilation, he committed a sort of vicarious suicide in nearly every one of his works. In them one finds either explicit physical suicide, a subsumed suicide motif, death imagery that points to selfdestruction, or some other indication that suicide was a constant obsession of Melville's. Even in Typee and Omoo (his first and certainly most pleasantly carefree novels) self-destructivity is apparent in the "ship-jumping" motif; men take French leave from their ships (one type of life) to enter another and more destructive sort of life. In Mardi, Taji's search for Yillah is a search for death, as he becomes his "own soul's emperor" whose first act is "abdication," the symbolic crossing of the reef beyond Mardi. And in Moby-Dick, Ahab's entire mad gesture in pursuit of the white whale is suicidal. But beyond this, Moby-Dick is pervaded by the suicide theme: Ishmael himself goes to sea as a substitute for "pistol and ball." Pierre, of course, contains explicit suicide, and the short magazine prose that followed is pervaded with stories of passive suicides like Benito Cereno and Bartleby, who just decide not to live in this world and so die. Billy Budd, in Melville's last work, becomes the apotheosis of this

In the realm of the cosmic or the metaphysical, Melville produced works which explicitly or allegorically explore the possibilities of various world outlooks or philosophical and religious systems and categorically

reject each system as impractical or lacking validity.

Mardi and Moby-Dick both represent voyages in search
of a workable life-theory, at the same time that both contain experimental microcosms (Mardi and the Pequod)
into which Melville attempts to cram as many representations of varying philosophies as possible. Pierre represents Melville's rejection of Christian virtue, and Clarel
and Billy Budd rejections of Christianity in general.

In his relationships with his human brothers, Melville's growing cynicism and misanthropy are mirrored in the changes in the theme of "brotherhood" in his works. In the early idyllic works, the central character always forms a close attachment to a male companion. This theme changes in Pierre to something unpleasant (homosexuality), and by the time of The Confidence-Man has turned into a snarling misanthropy.

Hence, Melville's final answer to the question of possible value-systems in the universe becomes a resounding no, an exploration of nothingness, and documents concerning his personal life show a parallel to my exegesis of his work. Microfilm \$8.80; Xerox \$29.80. 695 pages.

#### T. S. ELIOT AND THE IDEA OF LITERARY TRADITION.

(L. C. Card No. Mic 59-3090)

Ernest Philip Bollier, Ph.D. Columbia University, 1959

This essay is an attempt to define T. S. Eliot's idea of literary tradition as a critical concept and to determine. how it functions in his criticism. The Sacred Wood suggests that the problem which the idea was intended to resolve was one of knowledge and that what poets or critics should know was, from the beginning, part of the larger problem of what all men should know. Eliot's idea was influenced by 1) Arnold and his disciples, the American Neo-Humanists, 2) the French Neo-Classicists, and 3) Ezra Pound, T. E. Hulme, and Rémy De Gourmont. All were skeptical of rational modes of cognition; all made an empirical appeal to immediate sensory experience; all believed that although history meant change it did not mean progress and that beneath historical flux certain constant truths or values remained. They sought to preserve these constants and bring them to bear upon the present. Philosophical Idealism, particularly F. H. Bradley's, held very similar views. Bradley's theory of knowledge, although contributing to Eliot's skepticism, also prepared him for knowledge by faith, for Bradley held that whatever was experienced was real. In historical Christianity Eliot found that consensus with the dead which contributed to his conversion. The primary importance of his conversion to his criticism, however, is 1) that historically literary tradition has been associated with Christianity and 2) that Eliot no longer has had to seek "salvation" in literature as Arnold did, hence has been able to maintain a distinction between literary and ethical judgments. Nevertheless, the need for tradition, literary or cultural, arises from Eliot's belief that the individual is limited in what he can know or do. Eliot's anti-romanticism is directed against the refusal to recognize limitations; his classicism is an acceptance of them.

Hence, poetry and criticism, although both defined in terms of cognition, are separate activities with different functions, and the idea of literary tradition, intended not for geniuses but ordinary talents, is an idea of cooperative activity. What Eliot himself sought in tradition, on the other hand, was how to write poetry without raising the question of rational belief--hence, the impersonal theory of poetry, the preference for the dramatic-lyric mode, the notion that the only valid ideas in poetry were those presented as something perceived or experienced. His attempt in The Sacred Wood and Homage to John Dryden to define these qualities, found in poets he admired, in terms of a mechanism of sensibility and to explain the dissociation of sensibility as influenced by Milton and Dryden was not entirely successful. He discovered that the admired sensibility was a historical manifestation, contingent upon inherited religious attitudes, if not doctrine, and that because of fundamental changes of mind since the seventeenth century it could not be consciously recovered even by conversion. Still, this sensibility and its manifestation in language have been the main current of Eliot's own tradition. The correlative development of a poet's personal sensibility and his poetic idiom provides a rule of thumb to judge his relative stature; his use of language and its influence, its utility to others, also provide criteria. Nevertheless, Eliot's idea is primarily valid, not as a particular order of criteria, but as a directive to consider the whole of literature as a constantly growing body of data in which a constantly modified order of value may be discerned.

Microfilm \$5.15; Xerox \$18.20. 403 pages.

THE POETRY OF MARIANNE MOORE:
A STUDY OF HER VERSE, ITS SOURCES,
AND ITS INFLUENCE.

(L. C. Card No. Mic 59-3174)

Sister Mary Cecilia Carey, O.P., Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Frederick J. Hoffman

Tacitly rejecting the poetic forms that had been prevalent in English and American poetry, Marianne Moore in her poems offered an aesthetic based on language and form. Her theory of poetry, which she has carefully practiced, adequately explains its singular characteristics. Some critics, failing to grasp her purpose, have regarded her poems merely as examples of technical accomplishment. Others who have ignored the presence of a valid theory have labeled them "odd" or "eccentric." The key to objective appraisal lies in the organic unity of the poems. They are severely prescribed by her "eccentric," a limited but nonetheless wholly adequate one for her purposes. Considered by this means and with examples sufficient to illustrate her variety, Miss Moore's observations give convincing proof that they are genuine poetry. Their merits extend beyond the technical excellence ascribed to them and make an important, artistic

Marianne Moore's originality can be properly seen only in relation to various influences. These have intensified

her poetic development, but they have not made her either imitative or derivative. Her family, her education, books, personal friends, and literary acquaintances provided a milieu that encouraged her natural ability. Although she has been familiar with experimentalist writers and the important literary movements of her times, particularly the Imagist movement, she has remained completely independent. Despite her familiarity with many writers of poetry and prose, she has imitated none. Even her contributions to several of the little magazines have been given with no thought of supporting their literary policies. Her association with the Dial is the single exception of a magazine's definite influence upon her.

Marianne Moore's poetry is for the most part structured on free verse patterns and syllabic lines adapted from French prosody. In addition to its expert craftsmanship, it displays a rigorous intellectual discipline. Its diction and vocabulary are integrated components that dramatize eclectic subject matter and serious themes. Apparently opposed to her demand for poetic integrity are the prosiness of certain lines, unexpected word breaking, nontraditional rhymes, and an unusual typography. Her substitution of light rhyme, off rhyme, alliteration, and assonance, for regular rhyme, together with the unusual appearance of her poems has emphasized the "queerness" of her verse. When, however, we examine these characteristics in reference to her poetic theory, they testify to an integrated and legitimate poetic expression; they expand the vitality and importance of word juxtaposition and word relationships.

Her dominant themes, like her philosophy, are optimistic and center about moral values that account for poems related to the fable tradition. They emphasize in animal-human terms her favorite themes—human value, courage, fortitude, joy in achievement and the strength of persistent devotion. In her artistic approach and treatment of these themes she contradicts charges that her poems lack emotion. Miss Moore's finest achievements, especially in the poems of Nevertheless and What Are Years, show genuine emotion, rigidly controlled.

She has largely restricted her subject matter to images that help her to be clear, precise, and conservative, making use of a unique intellectual extension to transcend the danger of limitation. Drawing from history and technology, contemporary affairs in the world about her, the Bible, literature of many types, music, and painting, she provides "piercing glances" that illuminate her world of art objects, nature, human beings, and animals. Her intense absorption with animal images and her affinity for fables are responsible for her undertaking a translation of the Fables of La Fontaine that shows strengths and weaknesses important to her poetry.

To the writers of a younger generation she has made important contributions by stressing positive attitudes, the advantages of disciplined craftsmanship, and the vitality of the English language. Her influence is most valuable, however, for its insistence upon the artistic integrity of the individual poet.

Microfilm \$4.15; Xerox \$1.00. 321 pages.

BOCCACCIO'S NINFALE FIESOLANO: A TRANSLATION WITH INTRODUCTION AND NOTES.

(L. C. Card No. Mic 59-3097)

Daniel John Donno, Ph.D. Columbia University, 1959

The Ninfale Fiesolano holds a special place among Boccaccio's works both because it is generally esteemed his finest verse composition and because it marks a clear departure from several earlier literary tendencies. Probably completed shortly before work was begun on the Decameron, the Ninfale Fiesolano displays notable affinities to that masterpiece. It is essentially a novella recounting the unhappy love story of a shepherd and a nymph. But it is not exclusively so, for it contains mythological and pastoral elements commonly extraneous to that genre.

The Introduction to the present translation provides a thorough examination of the work. As precisely as possible, it seeks to set forth the role and function of all the various elements of which it is constituted. To this end the setting, the narrative structure, the presentation of characters, and the style are studied in turn. Comparisons are made with the author's other works with a view to showing the place the Ninfale holds in the development of Boccaccio's art. The sources, reputation and influence, and the problem of dating are also discussed.

As to the translation itself, it may be regarded as the first to appear in English. A sixteenth-century prose version by John Goubourne, based upon the French of Antoine Guercin du Creste, departs from the original too frequently and too radically to warrant authority as a translation. The present version, also in prose, aims to be as faithful to the letter and spirit of the original as acceptable English usage allows. Eschewing archaisms, it seeks to satisfy the needs both of those who want a reliable guide to the matter of Boccaccio's poem and of those who, having only an imperfect acquaintance with Italian, may find a translation useful in approaching the original. It also seeks to keep the reader at least conscious of the poetry through a judicious use of alliteration and rhythmical prose. Although the grammatical and syntactical liberties so widely present in Boccaccio's verse could not tolerably be reproduced in English, every effort has been made to keep the almost childlike simplicity, the charming freshness and directness of the original.

The Notes accompanying the translation are almost entirely devoted to analogues, many of which have not previously been noted.

Microfilm \$3.10; Xerox \$10.60. 237 pages.

THE GARNETT FAMILY.

(L. C. Card No. Mic 59-3108)

Carolyn G. Heilbrun, Ph.D.

Columbia University, 1959

This is the history of a literary family. Although they have served the world of English letters for nearly one hundred and fifty years, the Garnetts are among the least

chronicled of England's literary aristocracy, perhaps because they have contributed more by service to others than through their own creative work.

Chapter I starts with a short account of the historical background of the family in England and then describes the beginning of the literary line of the Garnetts with Richard (1789-1850) and his brother Jeremiah (1793-1870). Richard Garnett turned from a career in the family business to enter the Ministry and become a linguist, scholar, philologist and, finally, assistant librarian in the British Museum. Jeremiah was one of the founders of the Manchester Guardian and eventually its editor.

Chapter II deals with the career of the younger Richard Garnett (1835-1906), Keeper of Printed Books at the British Museum, author and editor of many books, who is still remembered as the ideal librarian. He had not only interest and influence in every sphere of library science -- he edited the first printed catalogue of the British Museum Library -- but his attitude of service to any seeker of knowledge, however unconnected or unendowed, set a standard for librarianship throughout the

Chapter III recounts the career of Richard's son, Edward Garnett (1868-1937). Edward Garnett early found his true calling as a publisher's "reader." Although he never sought to rise above that seemingly unimportant position, he exercised from it an immensely fruitful influence over the course of English Literature. For over forty years he read manuscripts, and with that rarest sort of critical faculty, discovered talent or genius unaided by any guide but his own judgment. It was said that in over forty years he never missed a talent. Once he had found one he would stop at nothing to bring it to fruition. Among those whom Garnett discovered and fostered were Conrad, Galsworthy, W. H. Hudson, D. H. Lawrence, T. E. Lawrence, Edward Thomas, Stephen Crane, Robert Frost. His relationship with these writers is illustrated by quotations from unpublished letters to him from D. H. Lawrence, Frieda Lawrence, Robert Frost, and E. M. Foster, as well as from Garnett's own unpublished letters to Conrad. The latter contain comments upon several of Conrad's works-in-progress. Garnett's published critical work and his generally unsuccessful creative efforts are also described and analysed.

Edward's wife, Constance Garnett (1862-1946), is the subject of Chapter IV. One of the first English women to attend Cambridge University, Constance Garnett was the translator from the Russian of that literature which so profoundly moved the English-speaking world and awakened its writers to new awareness in the early years of the Twentieth Century. For millions of readers of Russian literature, Constance Garnett's translations were the channel through which it first came. Though shy and retiring, she knew many of the important figures of her day -- she might have married Shaw. This chapter, the first account of her life, reveals that she was not, in fact, the "prudish, typical Victorian" she has often been called.

An epilogue discusses the career of David Garnett ), the son of Edward and Constance. He has provided much of the original material used in this work; his own memoirs, published in three volumes under the general title The Golden Echo, recount his life in much

The published works -- those they wrote, introduced, translated and edited -- of the younger Richard Garnett,

Edward Garnett, Constance Garnett, and David Garnett are listed in an appendix.

Microfilm \$3.85; Xerox \$13.00. 297 pages.

CONSCIOUSNESS AND THE UNCONSCIOUS IN THE DRAMAS OF HEINRICH VON KLEIST: KLEIST'S STRUGGLE FOR INDIVIDUATION.

(L. C. Card No. Mic 59-2446)

Valentine Charles Hubbs, Ph.D. New York University, 1959

Adviser: Dr. Arthur Geismar

Kleist's preoccupation with the infinite realm of the unconscious was indicative of the lack of inner order and harmony which plagued the poet all his life. The purpose of this dissertation is to show the conflict of consciousness with the unconscious in the psyche of Heinrich von Kleist, his awareness of this conflict and his fervent longing for individuation, and how this conflict is reflected and resolved in his dramatic works.

The written record of Kleist's struggle with the conflict of consciousness and the unconscious began as early as 1799 when, in a letter to his former teacher, Martini, Kleist explained his reasons for leaving the army. According to this letter, the tensions produced by the conflict of opposites, tensions which were evident in his inability to act in harmony with both duty and inclination, became so unbearable that they made his position as officer untenable. The intensity of the unconscious forces which welled up within him made him seek in the rationalism of his era a guiding principle which could control these forces. But rational thought is powerless against these forces, and Kleist became painfully aware of this and, at the so-called Kant-crisis, he repudiated rationalism.

In his drama, Die Familie Schroffenstein, Kleist displays the knowledge of the psyche which his own struggles with the forces of the unconscious has given him. The unconscious exercises its influence on the drama and is responsible for the unfounded conclusions which the characters reach when they are confronted with circumstantial evidence. Thus, this drama is the tragedy of one-sided human beings whose mental powers have not been fully developed, e.g., Rupert projects his own evil into others; Jeronimus, the thinker, cannot penetrate the circumstantial evidence and arrive at the truth.

Amphitryon is a drama of wish-fulfillment which reflects the circumstances of Kleist's betrothal to Wilhelmine von Zenge and her subsequent marriage to Professor Krug. The depiction of himself as the god of thunder reflects Kleist's psychical inflation which resulted from his preoccupation with the unconscious. The drama also reflects the isolation and loneliness which Kleist suffered as a result of his inability to express the irrationality of the unconscious.

From Penthesilea, the psychopomp, we learn of the basic motivating forces of Kleist's psyche: the interdependent relationship of Eros and the will to power which were responsible for Kleist's fanatical nature. It was the intense passion motivated by these drives which made the struggle for individuation such an agonizing process.

Käthchen von Heilbronn is a part of the same psychical material from which Penthesilea was created, but Käthchen lacks the motivating forces of the will to power. In this drama Kleist takes a step in the direction of psychical harmony, for Wetter vom Strahl finds an outlet for both forces of the unconscious in his marriage to Käthchen.

Kleist's final drama, Der Prinz von Homburg, is a poetic depiction of the achievement of the goal of psychical equipoise, the state of individuation. This state of harmony cannot be brought about until the Prince is purged of psychical inflation by the cathartic experience of the fear of death; for in a state of inflation, the Prince has arrogated the power of the Elector to himself. Once the ego gives up this illusion, it is possible to bring about a state of harmony between the unconscious drives for fame and power and the demands of consciousness. Once this harmony is established, the Prince becomes a valuable leader, for he no longer lives in the narrow confines of an egocentric world.

Die Familie Schroffenstein, Amphitryon and Penthesilea depict psychical states as Kleist experienced them.

Käthchen von Heilbronn and Der Prinz von Homburg depict poetically the attainment of that balance which Kleist so fervently desired. But the goal of individuation was reached only in his poetic fancy; he never achieved this goal in life. He found harmony only for short periods, and he found relief only in death.

Microfilm \$2.55; Xerox \$8.80. 194 pages.

NATHANIEL HAWTHORNE, 1825-1850: LITERARY APPRENTICE, MAGAZINIST, AND EXPERIMENTAL CRAFTSMAN.

(L. C. Card No. Mic 59-3334)

Thomas Joseph McInerney, Ph.D. University of Washington, 1959

Chairman: Merrell R. Davis

This is a study of Hawthorne's tales and sketches against the literary-critical background of the period. Its purpose is twofold: to determine the extent to which his practice in these works was shaped by a desire to satisfy current standards of taste, and thus to provide a fuller understanding of his aims and a more accurate measure of his achievement.

Though American criticism during the period was vitiated by its excessive generalization and its "puffing" of native writers, among its positive attributes was a core of philosophy and aesthetics which had a pronounced effect on the writers' choice and handling of subject matter. The natural realism of the Scotch Common-Sense philosophers contributed strongly to the reaction against the extravagances of the gothic novel and continued to manifest itself throughout the period in the critical insistence on credibility in fiction. The prevailing aesthetic through the mid-1830's, associationism, stimulated the debate over the suitability of American materials for fiction. From 1835 through 1850, romantic organicism and idealism occupied an increasingly prominent place in critical thought. But criticism of fiction seldom ventured beyond the choice and general handling of subject matter to detailed structural analysis which could serve as a guide to the writer. The fiction in popular magazines and annuals amply attests to this deficiency nowhere more saliently than in its practical reflection of the common failure to distinguish between the tale (or short story) and the novel on any basis except length. The principal weakness of this fiction, however, was its pervasive sentimentality.

That Hawthorne was sharply aware of this environment is revealed by direct comments in his letters, criticism, and editorial writing. In general, his thinking parallels that of contemporary critics, associationism predominating through the 1830's, romantic idealism and organicism through the 1840's. Moreover, many of his comments -including those on his own "idle tales" -- echo the critical condemnation or, at least, the condescension towards popular fiction. Specifically, he comments on the poor quality of popular publications and on the debilitating effect of women writers upon American literature. By his own manner of handling the stereotypes of the sentimental tradition, he manifests indirectly, but unmistakably, his recognition of their vapidness. Finally, his advice about publication to Bridge and L. W. Mansfield reveals a keen awareness of the tastes of the American reading public.

Perhaps the clearest indication of the direction given his art by contemporary critical standards is the marked predominance through the 1830's of historical tales and sketches, many of which deal in the prescribed manner with those subjects recommended for their rich associations. In the late 1830's and the 1840's, however, he composed more varied types of stories, including a number of satires, a change which suggests his greater assurance and his embarkation on the experimental phase of his career. Another reflection of contemporary criticism, and of the literal-mindedness of the reading public, is his almost unremitting effort to forestall charges of improbability. Though his tales and sketches sometimes bear other marks of his participation in the popular market, he overcame the structural difficulties that plagued his contemporaries by his practice of focusing on a single idea, "to which all other ideas are referred and subordinate." This, in short, is the story of his career in popular fiction: his willingness -- especially in the beginning -- to satisfy current standards of taste, but a simultaneous artistry that enabled him to convert the popular mode to higher uses. Finally, the study deals with The Scarlet Letter not as a new departure in his art, but as the mature fruit of his apprenticeship and experimental craftsmanship.

Microfilm \$2.75; Xerox \$9.60. 212 pages.

VISUAL ORGANIZATION IN DICKENS.

W Constanted Strange of translations were the

(L. C. Card No. Mic 59-3337)
Harold Kennett Moritz, Ph.D.
University of Washington, 1959

Chairman: Wayne Burns

The purpose of this study is to integrate long-standing and wide-spread but fragmentary and unorganized observations that Dickens was a visual writer into a coherent critical image of Dickens. This study examines in what sense Dickens was a visual writer.

Chapters I-III examine three critical problems. Chapter I defines the peculiar relationship between people and things in the Dickensworld by analyzing Miss Dorothy Van Ghent's ideas of animation, "transposition process," and "reciprocal metaphor" as stylistic means of handling the theme of dehumanization, and by relating this dynamic to film theory. Chapter II mediates the historic battle between the detractors' view of Dickens' art as a limited "surface" art of externals without depth and the partisans' view that his art does penetrate the soul by demonstrating that Dickens' prose method and film method approximate each other in their management of both surface and soul. Chapter III, in distinguishing between two kinds of characters, the majors and the minors, notes the peculiar hybrid ambience of these two styles -- the ambience, incidentally, of animated cartoon--and argues that the minors are really the majors.

Chapter IV records citations about Dickens' visual percipience; documents how he saw the physical scene; documents how he saw character within that scene; analyzes his own double-vision; analyzes the semantics of "see," the optical metaphor, the term "point of view," and the term "perspective"; and documents how in his prose Dickens used motifs of the eyeball in a filmic manner. This chapter concludes that an unreservedly significant, if not central feature, of Dickens' work in his eye, which distorts the field of vision in such a peculiar way as to force his reader to see him not so much in terms of conventional literary and prose-fiction criticism as in terms of visual experience.

In contrasting David Lean's naturalistically conceived film Great Expectations with Dickens' novel, Chapter V measures the shortcomings of the film's naturalistic abstraction against elements of surrealism, fantasy, and animated cartoon technique which constitute Dickens' original style. In being untrue to Dickens' eye, the film perpetuated our conventional naturalistic conception of Dickens. The essential symbolic, expressionistic, and fantastic Dickens qualities emerge in three key scenes: Pip in the graveyard; Miss Havisham's Satis House; and Wemmick's Castle and Newgate Prison.

The analysis of the three characters and the three scenes attempts to demonstrate the filmic quality of Dickens' eye saturated upon the visible culture of the marsh landscape and recording the visual terror and estrangement of the orphan Pip; the analysis of Miss Havisham and her dark place suggests an expressionistic and animated cartoon visual rendering of nightmare; and analysis of Dickens' rendering of the cartoon figure of Wemmick in his physiognomy--the emblem of his dehumanization--in his motion, and in the comedy of things both at Walworth and at Newgate, indicates an abortive attempt to yoke contradictories that is a characteristic flaw of Dickens. Wemmick the Walworth gardener, puttering in his garden, and Wemmick the Newgate gardener, soliciting portable property from the condemned, remain unresolved by Dickens. Wemmick finally is an amalgam of both property values and personal values. Dickens was both an entertainer and an artist.

This study confirms Sergei Eisenstein's idea that Dickens' prose was a scenario-prose and argues that a cinematic imagination dedicated to what Béla Balázs has called "visual existence" informs that prose. The impetus is visual. Dickens saw better than he felt. His eye was superior to his heart. Microfilm \$4.55; Xerox \$15.20. 355 pages.

IMAGERY IN THE POETRY OF AGRIPPA D'AUGIBNE.

(L. C. Card No. Mic 59-3277)

John Thomas Nothnagle, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Alfred Glauser

The image is one of the most important elements of poetry, for it reflects the worlds of the poet, the exterior reality that inspires him and the interior reality of passion and thought. With D'Aubigné the image acquires an even greater importance since the majority of his images, in the poetry of love, France, and God, exist in a coherent, meaningful pattern. For analysis in this study they have been classified as simple, complex, and pure images. The first is a description, a mere picture in words. The complex image is produced by the implied or expressed comparison of two objects and includes the figures of speech. The pure image is produced by the fusion of two or more objects from which results a new object. Such an image, proceeding from intuition rather than perception, may be intimately bound to the poet's experience and passion.

Study of the images in the poems of love, France, and God shows that D'Aubigné attains the intuitive state of the pure image within the world of his poetry and in a discernible pattern revealed in the complex images. In the love poems to Diane of Le Printemps he begins on the level of the complex image with a variety of figures drawn from the Petrarchan canzonieri. He perceives in this imaginative world of fire and violence the true nature of the beloved, the lover, and passion. These are fully revealed in the images of sacrifice that close L'Hécatombe. Here the poet finds death, the pure image of love, which he explores in the first poems of Les Stances.

A full progression from the simple to the pure image is seen in the poetry of France and God of Les Tragiques. The spectacles of war and persecution provide abundant material for vivid and moving simple images. But it is the complex imagery that shows the direction of imaginative creation. Depicting the troubles of his country D'Aubigné likens the warring factions to mutinous groups doomed to destruction. The nation itself is seen as a body, then a woman, finally a mother. These coincide in the pure image of maternal France, a creation that lives with a life of its own to convey the poet's pessimism and despair at the plight of France. In the complex images of God, allegory and anthropomorphism define precisely good and evil and emphasize the dramatic nature of the conflict between God and Satan. Throughout these images the necessity for justice becomes more evident and pressing until the very movement of his creation brings the poet to his pure image of God, the omnipotent arbiter of the last judgment. With this image D'Aubigné assimilates himself to God in the assembly of creation, and to humanity in the experience of both hell and heaven.

Considered as a whole D'Aubigné's imagery shows a remarkable integrity. In addition to the recurring progression from the simple to the pure image there is also the persistence in his poetry of certain symbols and themes, tones, and patterns of expansion, concentration, and movement. All of this shows that his poetic world is an intensely personal creation where the image, resulting

from the interplay of association and suggestion, is not only a stirring penetration of reality but also a record of poetic experience.

Microfilm \$4.45; Xerox \$15.00. 347 pages.

### WIELANDS DRAMATISCHE TÄTIGKEIT (WIELAND'S DRAMATIC ACTIVITY).

(L. C. Card No. Mic 59-2492)

Leslie John Pápay Parker, Ph.D. The University of Texas, 1959

Supervisor: Dr. Helmut Rehder

The works of Christoph Martin Wieland (1733-1813) stand by themselves in the literary history of his time. His novels and plays, his epics and satires, constitute something of an extravaganza in the Age of Reason; he himself being an anomaly in German letters, as the cultivator of Greek and Latin ideals in a culture devoted to narrow and bourgeois didacticism. His facile pen led to an emancipation of poetic language and imagination hitherto captivated by courtly formalism and bourgeois stolidity.

Wieland's merit lay in the fact that he helped to counterbalance the predominant trends of his time. He seasoned Richardson's realism with a flair of gracefulness and Rousseau's sentimentalism with a grain of irony. He gave the German novel that predominantly psychological and pedagogical character which was continued by Goethe and became the main current of 19th-century German literature. He provided a sober antidote to the literary excesses of the "Sturm und Drang" - and established, by translating liberally from almost every European literature, a truly cosmopolitan standard in German fiction.

An admirer of Euripides, Lucian, Shakespeare, Shaftesbury and Sterne, Wieland incorporated their intrinsic thoughts into his Weltanschauung thereby widening his own philosophy so as to become realistic, practical, European in outlook. Though he neglected, perhaps, the German past, in which Klopstock had once awakened interest, he introduced to Germany the splendor of Greek antiquity which became his permanent educational ideal throughout his life. He gave German letters a pseudo-Hellenistic ring which later Goethe transmuted into genuine humanistic values. But in producing a Greek background, Wieland in effect, reflected the hopes and limitations of 18th-century realism.

As a translator Wieland deserves much credit for his rendition of twenty-two Shakespearean plays. Midsummer Nights Dream he rendered in blankverse, the others in prose. This was the first nearly complete translation of Shakespeare's works in Germany, or on the Continent for that matter. His poetic talents shone particularly bright in the lyrical parts. As a dramatist, he tried his hand at both the tragic and the lyric form, with far better success in the latter (Singspiel) than in the former.

He created two tragedies: Lady Johanna Gray (1758) (after Nicholas Rowe), dealing with an episode from English history. Written in blankverse, it is a product of two moods: Shakespearean in language and thought,

sentimental in dramatic contents. Clementina von Porretta (1760) was adapted in prose from Richardson's novel Sir Charles Grandison. His best "Singspiel" was Alceste (1773) in which his superlative poetic style successfully blended classic simplicity with romantic melancholy. It was inspired by Euripides although it followed Wieland's own dramatic theory. Rosemunde (1778), the second of his musical plays, was suggested by Addison. The artistic complexities in this Singspiel and the psychological tension within its central characters create a truly dramatic atmosphere. In Pandora (1778), a comedy suggested by LeSage, Wieland introduced the figure of Prometheus, a brooding, tragic character diffused with a Faustian mood. Das Urtheil des Midas (1779), was intended as a farce in which the poet ridiculed the literary critics of his time. Die Wahl des Herkules (1773) was adapted from Xenophon, patently depicting the conflict of virtue and vice. This play, however, beautifully versified, became a masterpiece of lyrical expression and philosophical thought, with Herkules depicted as the epithomy of a Faustian vision of the world. A critical evaluation of Wieland's influence upon some of Goethe's and Schiller's dramatic works completes the study.

Microfilm \$4.10; Xerox \$13.80. 318 pages.

JOYCE: THE IMMOBILIZED ACT.
(L. C. Card No. Mic 59-3342)

Stanley Horn Poss, Ph.D. University of Washington, 1959

Chairman: James Hall

I have tried to avoid a critical reductivism in this essay on James Joyce's Dubliners, A Portrait of the Artist as a Young Man, and Ulysses, on the assumption that large, inclusive formulations on art appear more important than they are. Still, one does need a critical approach to Joyce. The problem is to find one flexible enough that it does not commit its user to examining only those parts of the canon that bear on the pre-established critical abstraction. Joyce has something for everybody it would seem, for Thomist, Marxist, surrealist, common reader, bohemian, academician, symbolist, naturalist, and more have all entered his mazes, and all have been able to find their own preoccupations. However, under this diversity of approaches one can find a major area of agreement: the recognition by all of his commentators that Joyce's obsessive interest in words is unique even in a genre where such an interest is a professional necessity.

In nearly everything I read on Joyce I found an acknowledgment of his virtually animistic identification of word and thing (referent), to the degree that in his fiction there are relatively few acts as such: instead, his characters inherit his own inclination to act through language --that is, actual talk, and dream, fantasy, imagination-rather than literally.

The world of Dubliners is paralyzed by inaction; talking is the principal activity. In the Portrait, Stephen Dedalus, the proto-artist, never really creates anything much; instead, the novel consists of lengthy sections of internal monolog with interpolations of actual conversation.

(Significantly, the most sophisticated rhetoric of the book, a pseudo-Platonic dialog on esthetics, comes immediately before Stephens's most considerable artistic effort, a fifth rate villanelle.) Ulysses shows a clear movement from relative simplicity to the most elaborate and virtuosic manipulation of language, so that the significance of the famous meeting of Bloom and Stephen, Ulysses and Telemachus, that occurs toward the end of the novel is concealed behind the dazzle of the verbal fireworks.

I have attempted in this dissertation to trace the concept of what I have called the immobilized act. Throughout the three works on which I concentrate there is little action as such. One finds instead that the undeniable vitality of Joyce's works subsists in their language, rather than in the lives and actions of his characters. Under the paradoxically swarming diversity of the paralyzed world he has recreated is the recurring situation of characters trapped by their lives, unable or unwilling to act themselves out of their various impasses. His central characters are immobilized in their own obsessive attitudes; though they sometimes try to break out of their separateness, they never do, since the obsessions with which Joyce has hemmed them in are stronger than their efforts to escape their isolation. I believe that the Joyce world consists of a series of immobilized acts; and since I believe that this premise is the essential "given" in any discussion of Joyce's works I have used it as a point of departure for this dissertation.

Microfilm \$2.95; Xerox \$10.20. 228 pages.

#### THE TECHNIQUE OF CHARACTERIZATION IN THE LATE NOVELLAS OF THEODOR STORM.

(L. C. Card No. Mic 59-3130)

Willy Schumann, Ph.D. Columbia University, 1959

This study aims to contribute to a deeper understanding of Theodor Storm's works by examining in detail his technique of character-drawing in the later novellas.

Storm (1817-1888) was one of the most eminent representatives of Poetic Realism in German literature. His fame rests on some fifty novellas and a substantial body of poems. It is especially the later works, written after 1870, upon which Storm's reputation as a great Poetic Realist is firmly based. In these stories he leaves behind the "Biedermeier" mode and certain vestiges of Romanticism and achieves a true break-through towards Realism which aligns him with the future.

It is customary to distinguish between direct and indirect methods of characterization. The direct method, that is to say, the direct specification of character traits when a person is first introduced is of little significance in Storm's prose work. When he introduces a person, he visualizes him immediately, his outward appearance, gestures, manner of moving about, and so forth, or he has him speak.

Close and repeated examination of these indirect methods suggested eight major means of characterization. They form the titles of the chapters of the main part of this study: 1. Appearance; 2. Eyes and Hands; 3. Clothing; 4. Gestures; 5. Movements; 6. Voice and Manner of

Speaking; 7. Occupation and Social Class; 8. Environment. Storm creates characters who are real and convincing, who stand out vividly and whom we remember by fairly detailed evocation of their outward appearance, with special emphasis on the hands, the eyes, and the clothing, by very frequent gestures, by the way in which they move about, by specific and repeated references to their voices and manner of speaking, by careful adjustment of occupation, great circumspection and precision in depicting the environment.

An essential result which may be claimed for this study is the fact that, on the basis of his powers of charactercreation, it helps to acquit Storm of the charge of narrowness and provinciality which has sometimes been brought against him. It is true that Storm generally limits himself to certain social groups. The middle-class citizen, the Bürger, dominates the majority of these stories. Storm ignores entire classes and areas of activity, for example, the proletariat, technology, and industry. But these things were not so highly developed and problematical in Storm's time, nor as yet a burning issue in literature.

His protagonists, nevertheless, both men and women, often have towering stature, in contrast to his early novellas where young girls, old men, and children carried the plot. If Storm moved within the confines of the "Burgertum," it was in the interests of the authenticity of his art, for it was the liberal middle class that he knew best in breadth and depth, and it was this class that constituted the social matrix of Poetic Realism, of which Storm was

the last great master.

As to the question whether Storm has contributed anything new to the art of character-creation, one has to say this: no one would seriously wish to contend that Storm was a literary Avantgardist. As far as the means of characterization are concerned, it can indeed be said that he has not added any radically new tools to the equipment of the creator of characters in fiction. The use of gestures and of the environment are perhaps the two fields where he excels most and points to the future. His most conventional level, on which he is by no means boring or vapid, is description of the outward appearance of a person. The spoken word lies somewhere in between in characterizing Microfilm \$3.95; Xerox \$13.40. 306 pages.

### THE ENGLISH ROMANTIC POETS AND THE EPIC.

(L. C. Card No. Mic 59-3297)

Brian F. Wilkie, Ph.D. The University of Wisconsin, 1959

Supervisor: Associate Professor Alvin Whitley

"The English Romantic Poets and the Epic" is a study of certain major poems of the English Romantic period from the point of view of epic intention, structure, and devices. The dissertation is not an attempt to summarize general attitudes toward the epic in the Romantic period; instead, the poems treated are approached on their own terms. The works studied are Wordsworth's The Prelude, which, without being an epic, contains important epic elements, Keats's Hyperion, Shelley's The Revolt of Islam, and Byron's Don Juan. In addition, a preliminary chapter

treats Southey and Landor and their part in ushering in the "epomania" of the 1790's.

Since the number of poems which are unquestionably epic is very small, I define the genre empirically; that is, a poem is considered an epic if it imitates or adapts the conventions of earlier epics to a significant extent. However, the study tries to show that the Romantic poets often transformed the traditional idea of heroism, reinterpreting it in spiritual or esthetic or psychological terms. But this reinterpretation is itself traditional, since such Renaissance epic poets as Milton, Tasso, and Camoens also repudiated the classic conceptions of heroism in favor of a truer heroic argument.

Despite the empiric definition, certain recurrent features of literary epic are discussed, for the Romantics often took these themes and adapted them to nineteenth-century or post-Revolutionary conditions. These themes and devices include the idea of the hero as a man with a divinely-appointed mission, the temptation of the hero to forsake that mission, the attempt to be doctrinal to a nation, the necessity for an epic to represent its age, and modern equivalents of the traditional epic "machinery."

Microfilm \$5.85; Xerox \$20.40. 459 pages.

MILTON'S USE OF TIME: IMAGE AND PRINCIPLE.

(L. C. Card No. Mic 59-3369)

Laurie Bowman Zwicky, Ph.D. The University of Oklahoma, 1959

Major Professor: Professor Kester Svendsen

Milton has been praised as the master of grand, vast perspectives of space, but little attention has been paid to his perspectives of time. He gives the impression of a temporal vastness similar to the great spatial distances when he works with the terms of time. Milton's concept of time is based on both pagan and Christian philosophy, and a background survey of philosophical theories and poetic uses will serve to illuminate Milton's concept and use of time. He can draw on Plato and Aristotle for ideas. but these references provide only an image, such as a comment about Heaven's Great Year, or Heaven's Aristotelian time. Milton uses man's measure of time as the basis for making clear God's nature, and from the perspective of man's time there seem to be two other kinds of time: divine and Satanic. The different times of Paradise Lost are shown in part by a series of discrepancies in the chronology, in part by a manipulation of tenses; the latter technique was perfected in "On the Morning of Christ's Nativity," where Milton illustrated the timelessness of Christ's Incarnation. This emphasis on timelessness and eternity is a key to Milton's use of time. He is a devoutly religious poet whose eye is constantly on God. He wishes to make the best of the present so that it will be remembered in eternity.

Milton's course of time is a straight line from the creation to the destruction of the world, marked by the kairos of Christ, the basis of Paradise Regained: there is a divinely appointed time for Christ to act, but Satan tries to get Christ to act before that kairos. Milton is sure that time will end, but all events must happen in God's due time. Ideas about time give Milton both images and principles of belief.

Microfilm \$2.00; Xerox \$6.20, 126 pages.

## MATHEMATICS

#### COMPACT COMPLEX HOMOGENEOUS MANIFOLDS.

(L. C. Card No. Mic 59-2220)

Hugh Norton Albright, Ph.D. (Brother E. Alban, F.S.C.) University of Pennsylvania, 1959

Supervisor: Dr. Morikuni Goto

The dissertation topologizes and gives the dimension of the set of invariant complex analytic structures on a compact homogeneous manifold. More precisely, let G be a compact connected Lie group and B a closed connected Lie subgroup of G. Let M be the homogeneous manifold of left cosets of G modulo B, upon which G acts transitively on the left. A complex analytic structure on M is G-invariant if and only if G becomes a group of complex analytic transformations of M.

The first section of the present dissertation gives a summary of the work of B. Eckmann and A. Frolicher (1951) which reduces the study of complex structures on a

manifold to that of certain endomorphisms of the module of vector fields tangent to the manifold. The second and third sections give an elaboration of J. L. Koszul's method of reducing this study in the case of homogeneous manifolds to that of certain vector space endomorphisms of the Lie algebra of G. The fourth section summarizes some of the classical results of H. Weyl on the structure of semisimple Lie algebras, and gives a theorem of Harish-Chandra (1955) of positive roots systems of the letter.

In 1958 J. Hano generalized the basic results of H. C. Wang (1954) on compact complex homogeneous manifolds, and furthermore studied the conformal vector fields of a given complex structure as well as the corresponding so-called characteristic subalgebra of the Lie algebra of G. Section five of the present dissertation starts with Hano's fundamental existence and uniqueness theorem for characteristic subalgebras, and by rather extensive modifications of Hano's methods, constructs explicitly all the invariant complex structures on M.

The sixth and last section of the present dissertation topologizes the set of invariant complex structures on M and gives the following formula for its dimension:

dim 
$$B_c^1 + \left[ {t \choose n} - 1 \right] + n^2/2$$
,

where B' is the derived group of the centralizer of B in G, t = rank (centralizer of B in G), and n = rank G - rank B. Microfilm \$2.00; Xerox \$3.00. 34 pages.

### LINEAR FILTERS ON A SEQUENCE SPACE.

(L. C. Card No. Mic 59-3539)

T. F. Bridgland, Jr., Ph.D. The University of Florida, 1959

The class of infinite lower semi-matrices and a subclass of this--the diagonally invariant matrices--are characterized algebraically and topologically; the latter class is shown to comprise a representation of a certain class of linear transformations--the displacement transformations--on the linear space of all sequences with complex entries.

The theory thus derived is applied to the rigorous formulation of the theory of sampled-data control. The mathematical tools derived on an heuristic basis by control theorists, including the z-transform and its modifications, survive in the rigorous formulation with considerable light being cast on previously obscure portions of the theory.

The central result of the dissertation is the formulation—again utilizing the infinite matrix theory developed at the outset—of the operational method of numerical quadrature of linear ordinary differential equations conceived by Tustin and extended by Madwed and others. This new formulation permits casting Tustin's ideas in a rigorous form involving only elementary results from the calculus. Several interesting new results of a general nature are derived, including an error analysis and a new algorithm for the approximate solution of linear ordinary differential equations.

Microfilm \$2.00; Xerox \$3.80. 70 pages.

### SOME GENERALIZATIONS OF METRIC SPACES.

(L. C. Card No. Mic 59-3316)

Jack Gary Ceder, Ph.D. University of Washington, 1959

Chairman: Ernest A. Michael

A class of topological spaces, called M-spaces, are studied. Metric spaces and CW-complexes are M-spaces. M-spaces are paracompact and perfectly normal. It is shown that, like the case in metric spaces, a subset of an M-space is an M-space; a countable product of M-spaces is again an M-space; an M-space which is a Go in some compact Hausdorff space is metrizable with a complete metric; and separable is equivalent to Lindelöf in an M-space. Moreover, unlike the case in metric spaces,

the quotient space obtained by identifying the points of a closed subset of an M-space is again an M-space (for metric spaces such a quotient space need not be first countable).

Microfilm \$2.00; Xerox \$3.00, 43 pages.

### A STUDY OF A LINEAR ORDINARY SECOND ORDER DIFFERENTIAL EQUATION WITH FIVE REGULAR SINGULAR POINTS.

(L. C. Card No. Mic 59-3541)

Henry Lawrence Crowson, Ph.D. The University of Florida, 1959

This study initially surveys a segment of the background of differential equations. The canonical form of an equation with three non-elementary regular singular points is then derived. Certain constants in the canonical form are specialized, and the result is an equation with two regular singular points. This latter equation is then solved in closed form.

The derivation of a differential equation with five elementary singular points is given, and this is followed by a derivation and discussion of the equations of Lamé, Mathieu, Legendre, Bessel, Weber, and Stokes, respectively.

After a brief discussion of Heun's equation, which is an equation with four non-elementary regular singular points, an equation with five non-elementary regular singular points is derived. A general solution of this equation, in a neighborhood of z=0, is given.

Scheffé's criteria are discussed and then applied to the aforementioned general equation with five non-elementary regular singular points. A solution is then given in a neighborhood of each of the singular points z=0, 1, a, b, and  $\infty$ . A solution is also given in a neighborhood of an ordinary point z=d.

This study is culminated by the following theorem which is proved in Chapter VIII.

Theorem: Let 
$$p_j(z) = \sum_{i=0}^{j+2} C_{i,j} z^i$$
, where

 $C_{i,j}$ , (j = 0,1,2), are constants. A necessary condition for non-confluent forms of the differential equation

$$\sum_{j=0}^{2} p_{j}(z) \cdot \frac{d^{j}u}{dz^{j}} = 0 \text{ to have solutions in a neighborhood of }$$

any point, which are expressible in terms of hypergeometric functions, is that Scheffé's criteria be applicable to p<sub>i</sub>(z). Microfilm \$3.30; Xerox \$11.20. 253 pages.

CONTINUOUS MAPPINGS OF THE PSEUDO-ARC.

(L. C. Card No. Mic 59-3301)

Lawrence Fearnley, Ph.D. University of Utah, 1959

Chairman: R. E. Chamberlin

At the Summer Institute on Set Theoretic Topology at Madison, Wisconsin, July 24 to August 20, 1955, the question "What characterizes all continuous images of the pseudo-arc?" was raised by R. H. Bing. In particular, it was asked whether or not there is a characterization of the continuous images of the pseudo-arc analogous to the characterization of the continuous images of the arc given by Hahn and Mazurkiewicz. In this paper we investigate this question and investigate the class of continuous images of the pseudo-arc in general. Among the questions considered are the following three which were suggested during the preparation of this paper by Professor R. E. Chamberlin: First, "Is every chainable continuum a continuous image of the pseudo-arc?", second, "Does there exist an acyclic continuous image of the pseudo-arc which is not a quasi-complex?", and third, "Is every treelike continuum a continuous image of some chainable continuum?"

In the first chapter a characterization of the continuous images of the pseudo-arc is established and it is shown that if the definition of local connectedness is suitably reformulated as a global property, then this characterization is analogous to that of Hahn and Mazurkiewicz for continuous images of the arc. This characterization proves to be applicable to the succeeding problems of the paper and in particular, in Chapter I, it is used to show that all chainable continua are continuous images of the pseudo-arc.

In the second chapter it is shown that a continuum which is either a finite union or a countable topological product of continua which are continuous images of the pseudo-arc is itself a continuous image of the pseudo-arc. It is also shown that the second question of Professor Chamberlin has an affirmative answer and that, specifically, an example of a contractible continuum which does not have the fixed point property given by S Kinoshita is a continuous image of the pseudo-arc.

Finally a conjecture that all compact metric continua are continuous images of the pseudo-arc is found to be false. In Chapter III a series of examples are given to show that the pseudo-arc cannot be mapped continuously onto all tree-like continua, onto all arcwise connected compact continua, or onto all compact continua which are n-aposyndetic for each positive integer n. It is also shown in this chapter that the third question of Professor Chamberlin has a negative answer.

Microfilm \$2.00; Xerox \$3.00. 58 pages.

# TABOO GENERATING FUNCTIONS AND OTHER TOPICS IN MARKOV CHAINS.

(L. C. Card No. Mic 59-3099)

Peter Frank, Ph.D. Columbia University, 1959

This thesis is concerned with Markov chains with a countable number of states, S, and discrete time. There are five sections.

In Section 1, taboo generating functions are defined and several relations between them are proved. If the  $P_{ij}$  are single step transition probabilities and  $T \subset S$ ,  ${}_TP_{ij}^{(n)}$  is defined as the probability of going from i to j in n steps and not encountering the set T in the intervening steps. For n=0, let  ${}_TP_{ij}^{(n)}=0$  unless i=j and  $i \not\in T$ ; in the latter case  ${}_TP_{ij}^{(n)}=1$ . Define  ${}_TP_{ij}(z)=\sum_{n=0}^{\infty} {}_TP_{ij}^{(n)}z^n$ .

If T is finite, formulas are given which express  $_TP_{ij}(z)$  as a rational function of  $[P_{kl}(z):k \text{ and } l \in T \cup (i,j)]$ . An inverse of this relation is also given.

In Section 2, some results of Chung are generalized to null chains. In a recurrent chain, the following two func-

tions have limits as  $z \uparrow l$ ;  $\frac{iP'_{ii}(z)}{jP'_{jj}(z)}$  and  $\frac{jP'_{ij}(z) + iP'_{ji}(z)}{iP'_{ii}(z)}$ .

An example is given where  $\lim_{z \uparrow 1} \frac{jP'_{ij}(z)}{iP'_{ii}(z)}$  does not exist;

when it does exist, it can be thought of as a measure of how long it takes to go from i to j compared with the recurrence time to i.

In Section 3, the formulas of Section 2 are used to investigate changes in the behaviour of a Markov chain due to changes of the  $P_{ij}$ . For certain kinds of changes, called alterations, detailed formulas are given for changes in the generating functions, mean passage times and stationary measures.

In Section 4, it is shown that given an arbitrary set of positive weights  $[W_i]$ , there exists a recurrent Markov chain which has these weights as a stationary measure. A simple property characterizing transient chains is also presented.

In Section 5, theorems of Lamperti are employed to show that the recurrence time random variables for the different states of a null Markov chain all belong to the domain of attraction of a particular stable law if one state does. If the above is true, then the limiting distribution of the time since the last visit to a finite set of states divided by the current time exists and is independent of the particular set of states chosen.

Microfilm \$2.00; Xerox \$5.00. 96 pages.

extensions of the operator  $e^{a^2tz^2}$  and their inversions.

(L. C. Card No. Mic 59-3002)

Johnny Ray Johnson, Ph.D. Alabama Polytechnic Institute, 1959

Supervisor: Ernest Ikenberry

It is readily verified that u(x,t) = Lv(x), where  $L = \exp\left\{a^2(t-t_0)\frac{d^2}{dx^2}\right\}$ ,  $t > t_0$ , satisfies the diffusion equation,

 $\frac{\partial u}{\partial t} = a^2 \frac{\partial^2 u}{\partial x^2}$ , provided Lv(x) exists. Applications fre-

quently require obtaining solutions u(x,t) of the diffusion equation which satisfy certain boundary conditions at the end-points of an interval [c,d] and which approach a given v(x) on (c,d) as  $t \to t_0^+$ , where v(x) belongs to B, the class of all bounded functions which, in case the interval of interest extends to  $\frac{1}{2} \infty$ , are absolutely integrable on every finite interval. The first major purpose of this dissertation is to obtain extensions  $\hat{L}_M$  of L to a domain which contains B, such that, for any  $v(x) \in B$ ,  $\hat{L}_M v(x)$  satisfies the diffusion equation and the boundary conditions. The second major purpose is to obtain conditions which a given function u(x) must satisfy in order that there exists a function v(x) such that  $v(x) = \hat{L}_M v(x)$ . Results recently obtained by Pollard (Proc. of the Am. Math. Soc., 4, 4, pp. 578-582 (1953)) are extended and simplified.

Microfilm \$2.00; Xerox \$3.00. 34 pages.

ON THE LIMITING DISTRIBUTION OF -2 LOG λ IN THE NON-REGULAR CASE.

(L. C. Card No. Mic 59-3801)

Donald Akers Jones, Ph.D. State University of Iowa, 1959

Co-chairmen: Associate Professor Robert V. Hogg Professor Allen T. Craig

In testing of hypotheses, the likelihood ratio, usually denoted by  $\lambda$ , is frequently used. When the test is based upon a random sample (of size n say),  $\lambda$  is a measurable function which maps the set of the n dimensional Cartesian product space into the unit interval. In order to determine a desirable critical region for the test we must have some knowledge of the probability measure induced on the unit interval by  $\lambda$ . Since this is a difficult problem most results have been approximations.

Suppose that for a class of probability density functions which is indexed by an m dimensional parameter, it is required to test a hypothesis which reduces the dimension of the parameter space to h. It is well known that if the class satisfies certain regularity conditions with respect to the parameter, then the sequence (on n) of distributions of  $-2 \log \lambda$  will converge to the chi-square distribution with m-h degrees of freedom when the hypothesis is true. If the hypothesis is not true, then the sequence of distributions converges to a non-central chi-square distribution.

When some of the components of the parameter have been introduced by truncating the probability density functions of a regular class, then this new class will fail to satisfy the regularity conditions and the previous results will not be valid.

Consider a class of probability density functions defined on one dimensional Euclidean space which is indexed by a three dimensional parameter, where two components of the parameter possess the properties of the end point parameter of a truncated distribution and the third component is "regular". In this paper it is shown that for testing a hypothesis which specifies the values of b (b = 0,1, or 2) end point components of the parameter and specifies the values of d (d = 0 or 1) regular components, the sequence of distributions of -2 log  $\lambda$  will converge to the chi-square distribution with 2b + d degrees of freedom when the hypothesis is true. Also included in the paper are some extensions to problems involving more than one such class of probability density functions and to problems with more general types of hypotheses.

Microfilm \$2.00; Xerox \$3.00. 33 pages.

#### ON PAIRS OF DIOPHANTINE EQUATIONS.

(L. C. Card No. Mic 59-3552)

Amin A. Muwafi, Ph.D. The University of Florida, 1959

This dissertation is concerned with the solvability, in integers, of the two simultaneous equations

(1) 
$$\sum_{i=1}^{n} c_i x_i^2 = a, \sum_{i=1}^{n} d_i x_i = b; (n = 2,3,4)$$

where  $a,b,c_i,d_i$  are all integers  $\neq 0$ . Formulas are given for all integral solutions of the second equation of (1).

Conditions are given for the solvability, in integers, of the two simultaneous equations

(2) 
$$\sum_{i=1}^{n} c_i x_i^2 = a$$
,  $\sum_{i=1}^{n} c_i x_i = b$ ;  $(n = 2,3,4,5)$ .

Moreover, if k is a positive integer and all the  $c_i$ , (i = 1,2,3,4) are positive integers, conditions are given for integral solutions of (2) for which each  $x_i$  of any solution is > -k. Microfilm \$2.00; Xerox \$3.60. 62 pages.

# IRREDUCIBLE REPRESENTATIONS OF CERTAIN MATRIX SEMIGROUPS.

(L. C. Card No. Mic 59-3343)

William Taylor Putney, Ph.D. University of Washington, 1959

Chairman: Edwin Hewitt

We let K, R, Q denote the complex, real, rational numbers respectively;  $0_n$  and  $I_n$  denote the zero and identity  $n \times n$  matrix; and  $\mathcal{M}_n(F)$  denote the  $n \times n$  matrices with entries from a field F. Let A be the set

of functions  $\lambda$  with domain K and range contained in K such that if a and b are in K,  $\lambda(a+b) = \lambda(a) + \lambda(b)$  and  $\lambda(ab) = \lambda(a)\lambda(b)$ , and if  $a\in Q$ ,  $\lambda(a) = a$ . Let  $\Lambda'$  be the set of all functions in  $\Lambda$  with their domains restricted to R.

For  $\lambda \epsilon \Lambda$  and n any positive integer, let  $\gamma_{\lambda,n}$  be the

mapping of the matrices  $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ ,  $\begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}$ ,  $\begin{pmatrix} 1 & 0 \\ 0 & a \end{pmatrix}$  into  $\mathcal{M}_n(K)$ 

defined by

$$\gamma_{\lambda,n} \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} = \begin{pmatrix} 0 & 0 & \dots & 0 & 1 \\ 0 & 0 & \dots & 1 & 0 \\ & \ddots & & \ddots & \ddots \\ 0 & 1 & & 0 & 0 \\ 1 & 0 & & 0 & 0 \end{pmatrix},$$

$$\gamma_{\lambda,n} \begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & \dots & 0 & 0 \\ 1 & 1 & 0 & \dots & 0 & 0 \\ 1 & 2 & 1 & \dots & 0 & 0 \\ & \ddots & \ddots & \ddots & \ddots & \ddots \\ 1 & {n-1 \brace 1} {n-1 \brack 2} & \dots & {n-1 \brack n-2} & 1 \end{pmatrix}$$

$$\gamma_{\lambda,n} \begin{pmatrix} 1 & 0 \\ 0 & a \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & \dots & 0 \\ 0 & \lambda(a) & 0 & \dots & 0 \\ 0 & 0 & \lambda^{2}(a) & \dots & \ddots \\ \vdots & \vdots & \ddots & \ddots & \ddots \\ 0 & 0 & 0 & \dots & \lambda^{n-1}(a) \end{pmatrix}$$

(Here a is any complex number.) Let  $\gamma'_{\lambda,n}$  be the restriction of  $\gamma_{\lambda,n}$  determined by letting a be any real number and  $\gamma_n$  the restriction of  $\gamma'_{\lambda,n}$  where a is any rational number.

The mappings  $\gamma_{\lambda,n}$ ,  $\gamma_{\lambda,n}$ , and  $\gamma_n$  have unique extensions  $\lceil_{\lambda,n}$ ,  $\lceil_{\lambda,n}$ , and  $\lceil_{n,Q}$  to  $m_2(K)$ ,  $m_2(R)$ , and  $m_2(Q)$  respectively that are irreducible representations. There are  $2^{2N}$  inequivalent representations of the form  $\lceil_{\lambda,n}$  and  $\lceil_{\lambda,n}$  and exactly one representation for each n of the

form no

Any extension of  $\lceil n,Q \rceil$  to a representation of  $m_2(R)$  has the form  $\lceil n,\mu \rceil$  for some  $\mu \in \Lambda'$ , and any extension of  $\lceil n,\mu \rceil$  to a representation of  $m_2(K)$  has the form  $\lceil n,\lambda \rceil$  for some  $\lambda \in \Lambda$ .

If  $\lceil$  is an irreducible representation of  $m_2(Q)$  such that the image of some singular matrix is not  $0_n$ , then  $\lceil$  is equivalent to  $\lceil \cdot \cdot \cdot \cdot \cdot \rceil$  for some positive integer n.

is equivalent to  $\Gamma_{n,Q}$  for some positive integer n. Every continuous irreducible representation of  $m_2(R)$  such that the image of some singular matrix is not  $0_n$  is equivalent to  $\Gamma'_{n,\mu}$  for some positive integer n, and  $\mu(a)$  = a for all a in R.

Microfilm \$2.00; Xerox 6.40. 133 pages.

ON THE HAMMER TOPOLOGICAL SYSTEM.

(L. C. Card No. Mic 59-3413)

Sheldon Theodore Rio, Ph.D. Oregon State College, 1959

Major Professor: B. H. Arnold

The general objective of this thesis is to further develop the properties of the Hammer topological system and to relate the system and its topology to other topological systems. A Hammer topological system consists of a quadruple (M,h,g,f) where M is a universe, f is a limit function defined on a certain class of subsets of M, g is the associated inclusion preserving enlargement function of f, and h is the associated closure function of g. The pair (M,h) comprises a Hammer topology. It is shown that for each subset M\* of M a relative Hammer topology (M\*,h<sub>r</sub>) exists wherein a set is closed if and only if it is the intersection of a closed set of M with M\*. Conditions are given for complete relative Hammer systems to exist on a subspace with the relative topology.

A neighborhood system is developed, and limit points and set closures are defined in terms of these neighborhoods. It is shown that with each Hammer topological system a neighborhood system can be associated so that each subset of the universe has identical sets of limit points and identical closures in each case. Conversely, with each neighborhood system a Hammer topological system can be associated so that the above properties hold.

A necessary and sufficient condition for a Hammer topological system to be a Fréchet (V) space is that the empty set be closed. For those Hammer systems where the empty set is not closed a procedure is shown for selecting a subspace of the universe so that with the relative topology it is a Fréchet (V) closure topology or under certain conditions a Fréchet (V) space. Conditions are listed for a Hammer system to be a Kuratowski topology. For those Hammer systems where the closure function fails to distribute over the union of some finite subclass an enlarged closure function is defined which does have the distributive property. Its class of closed sets is a subclass of the closed sets in the original topology.

Hammer topologies are defined in terms of classes of sets which are closed under arbitrary intersections and contain the universe as a member. An arbitrary class of subsets of the universe which contains the universe as a member is shown to be a base for the closed sets of a

Hammer topology.

For a given Hammer topology (M,h) conditions are given for a class of sets to be the range of an i.p.e. function whose closure function is h. The complex nature of this class of sets in general discourages direct construction. Instead, a method is given for defining a limit function from a given class of subsets such that its resulting topology is identical to the given one.

Microfilm \$2.00; Xerox \$3.00. 57 pages.

# DEVELOPMENT OF THE TESTING OF STATISTICAL HYPOTHESES.

(L. C. Card No. Mic 59-3135)

Francis Bernard Taylor, Ph.D. Columbia University, 1959

The purpose of this study is to give an expository account and critique of the historical development of the testing of statistical hypotheses, and to relate this development to the growth of statistics as a subject of instruction on the college level in the United States.

The development of the testing of statistical hypotheses appears to be rooted in early attempts to use probability inductively by means of the principle of inverse probability. Originated by Bayes in 1763, and generalized by Laplace in 1812, the principle of inverse probability provided the mathematical machinery for converting the a priori probability of an hypothesis into an a posteriori probability reflecting the additional information supplied by the occurrence of an event for which the hypothesis served as a possible explanation. Prolonged controversy over the principle of inverse probability centered about the logical justification of assumptions made concerning a priori probabilities, in particular, the assumption that in the absence of knowledge concerning them all hypotheses could be considered equally probable a priori.

By directing attention to the possibility of making rigorously exact probability statements about statistics characterizing a random sample, and by taking an active lead in the development of sampling distributions providing the means for making such statements, R. A. Fisher effected an orientation of the problem of statistical inference away from attempts to assess the probability of hypotheses via the principle of inverse probability toward the construction of exact tests of significance. Selection of the best from among several possible test criteria received extensive treatment in the theory of testing statistical hypotheses, developed by Neyman and Pearson in a series of memoirs beginning in 1928. The Neyman-Pearson theory provided a mathematical structure giving sharper definition to the problem of testing statistical hypotheses, facilitating recognition of the limitations of existing solutions, and suggesting fruitful areas for subsequent research in the development of nonparametric and sequential tests. Generalization and extension of the Neyman-Pearson theory resulted in Wald's theory of statistical decision functions.

Supplying a partial explanation for the preponderance of contributions from the English speaking world is the tradition of empiricism in British philosophy in contrast to the tradition of Cartesian rationalism pervading Continental modes of thought. Other patterns marking the development of the testing of statistical hypotheses include: (1) attempts to bring a priori information to bear on the problem of testing hypotheses, (2) periodic controversy stemming from confusion with respect to the interpretation of probability, and abetted by intransigence of the personalities involved, (3) progressive interaction between theory and application, (4) increasing mathematical content tending to make the theory of testing statistical hypotheses more abstract and aggravating the problem of communication between mathematical statisticians and research workers in empirical fields.

On the basis of an analysis of the implications for education in statistics, it is recommended that separate

college departments of statistics be established so as to secure an harmonious balance between theory and application and at the same time eliminate undesirable effects of the diversity of practice characterizing the teaching of statistics on the college level in the United States. Examination of selected college textbooks on statistics revealed that the development of the testing of statistical hypotheses produced a shift in emphasis from descriptive statistics to statistical inference. Publication of shorter works devoted to full length treatment of particular topics is suggested as a means of eliminating the undesirable side effects of this shift in emphasis and improving the caliber of college textbooks on statistics.

Microfilm \$3.50; Xerox \$11.80. 269 pages.

# A LOCAL-COEFFICIENT COHOMOLOGY THEORY FOR LATTICES.

(L. C. Card No. Mic 59-3367)

John David Thomas, Ph.D. The University of Oklahoma, 1959

Major Professor: Dr. John B. Giever

A regular lattice is defined by abstracting the properties of the lattice of open sets of a topological space, and it is noted that decompositions of topological spaces which are used in constructing the usual cohomology theories have associated lattices which are regular. Topological properties such as compactness, connectedness, normality, etc., are also defined for regular lattices.

Sheaves and presheaves over regular lattices are defined in a manner suggested by recent work of Godement (1958), and many of their properties are established. The canonical resolution of a sheaf is defined and the cohomology presheaf is obtained by applying the Mayer functor to the resolution, considered as a collection of cochain complexes. An analogue of the Cartan uniqueness theorem is established, and it is demonstrated that all acyclic resolutions of a sheaf give the same cohomology presheaf as the canonical resolution. This last theorem is proved using double complexes instead of the usual spectral sequence techniques, and it is shown that the double complex isomorphism theorems developed for this purpose, yield a relatively simple proof of Dowker's well-known theorem on the cohomology groups of relations.

Resolutions of the Alexander and singular types are defined using antipresheaves, and it is shown that if the underlying lattice is locally paracompact and Hausdorff that these are acyclic resolutions, and therefore give the same cohomology as the canonical resolution. In this case, one gets the usual cohomology with coefficients in a fixed group G by resolving the simple sheaf generated by the constant presheaf G.

Some finite lattices associated with cellular decompositions of certain simple spaces are considered and the construction of the canonical resolution of a simple sheaf over these lattices is carried out in detail. It is shown that one obtains the right groups in this case too.

A theorem of Hurewicz on generalized complexes is restated in this setting and its relationship to the Cartan theorem considered.

Microfilm \$2.00; Xerox \$3.60. 61 pages.

ORDERED PRODUCTS OF COMMUTATIVE RINGS.

(L. C. Card No. Mic 59-3349)

Burnett Roland Toskey, Ph.D. University of Washington, 1959

Chairman: Ross A. Beaumont

All rings considered in this thesis are commutative rings. If R,S are rings, then R is an S-algebra, if a composition  $xa \in R$  is defined for  $x \in S$ ,  $a \in R$  satisfying the algebra identities (x+y)a = xa + ya, x(a+b) = xa + xb, (xy)a = x(ya), and x(ab) = (xa)b = a(xb) for  $x,y \in S$ ,  $a,b \in R$ . If  $R_{\alpha}$  is an  $R_{\beta}$ -algebra for  $\alpha < \beta$ ,  $\alpha, \beta \in A$ , where A is a linearly ordered index set, we define the ordered product  $\prod_{A} xR_{\alpha}$  to be the set of functions, x, on A, with  $x_{\alpha} \in R_{\alpha}$ , and zero for all but a finite number of values. Addition is defined component-wise, and  $(xy)_{\alpha} = x_{\alpha}y_{\alpha} + \sum_{\beta > \alpha} (x_{\beta}y_{\alpha})$  $+y_{\beta}x_{\alpha}$ ) defines multiplication. A further restriction on the definition of ordered product makes the ordered product into a ring. Under natural restrictions, the generalized associative law:  $\prod_{A \cup B} xR_{\alpha} \cong (\prod_{A} xR_{\alpha})x(\prod_{B} xR_{\alpha})$  holds for ordered products. If  $\prod_{A} xS_{\alpha}$  is an ideal in  $\prod_{A} xR_{\alpha}$ , with  $S_{\alpha} \subseteq R_{\alpha}$  for all  $\alpha \in A$ , then we have  $(\prod_{A} xR_{\alpha})/(\prod_{A} xS_{\alpha}) \cong \prod_{A} x(R_{\alpha}/S_{\alpha})$ , and  $\prod_{A} xS_{\alpha}$  is termed an ordered product ideal. For any ideal, J, in an ordered product, J(max) is the maximal ordered product ideal contained in J and J(min) is the minimal ordered product subring containing J. To study the structure of ideals in an ordered product, we need only consider ideals J such

that J(max) = 0. If J(min) = RxS and J(max) = 0, then J is determined uniquely by a special type of isomorphism between R and S. Hence all ideals in an ordered product of a finite number rings can be constructed, when the ideals and subrings of the component rings are known.

If G is an R-module, then G can be considered as an R-algebra with  $G^2=0$ , and the ordered product GxR formed. If G is a divisible R-module, then every ideal in GxR is an ordered product ideal. If either G is a torsion free R-module or R is an integral domain with identity and G is a unitary R-module, then 1) Every ideal in GxR is an ordered product ideal if and only if G is a divisible R-module, and 2) If  $G \neq 0$  and  $R \neq 0$ , then GxR is an indecomposable ring. If G is an R-module, R has an identity, and R contains no nilpotent elements, then every ring direct summand of GxR is an ordered product ideal.

An ordered product is an integral domain if and only if the ordered product of each pair of component rings is also an integral domain. If i is an identity and e is an idempotent element in an ordered product, then  $i\alpha^2 = i\alpha$ 

and  $e_{\alpha}^3 = e_{\alpha}$  for all indices  $\alpha$ .

If an ordered product satisfies a chain condition on its ideals, then each component ring also satisfies the same chain condition. The converse is true in the case of an ordered product of a finite number of rings. If an ordered product satisfies DCC, then < is a well-ordering for the index set, and if it satisfies ACC, then > is a well-ordering for the index set.

Microfilm \$2.00; Xerox \$4.00. 75 pages.

#### MINERALOGY

GEOLOGIC SETTING AND ORIGIN OF THE GROUSE CREEK PLUTON, BOX ELDER COUNTY, UTAH.

(L. C. Card No. Mic 59-2981)

Walker Holcombe Baker, Ph.D. University of Utah, 1959

Chairman: Bronson Stringham

The southern portion of the Grouse Creek Mountains, located in northwest Utah, consists of about 6000 feet of sedimentary rocks. The stratigraphic column is made up of 1000 feet of Proterozoic phyllites, limestone, dolomite and quartzite; 250 feet of the Ordovician(?) Pogonip(?) formation and 450 feet of the Eureka(?) quartzite; 350 feet of the Devonian Simonson formation and in excess of 1500 feet of the Guilmette limestone; 800 feet of the Mississippian(?)-Pennsylvanian(?) Chainman-Diamond Peak(?) formation; 1000 feet of the Pennsylvanian-Permian Strathearn(?) formation; and more than 1000 feet of the Triassic Thaynes(?) formation. Pliocene sedimentary and volcanic rocks of the Salt Lake formation and an apparently local conglomeratic formation mantle the foothills of the range. The sedimentary rocks have the structure of a major horst composed of flexed sediments

broken into numerous fault blocks. Thrust faulting has played a minor role in the evolution of the structure.

An irregularly shaped Tertiary(?) granitic pluton appears to transect the structure of the sedimentary rocks. However, the alignment of the borders of the pluton with major faults in the sediments suggests that pre-existing faults partly governed the position of its borders. Its formation was essentially passive since the sedimentary rocks are not domed in the vicinity of the pluton.

The pluton has an exposed area of 10-1/4 square miles and a probable total area of 15 square miles. It is composed of quartz monzonite (93%) and quartz diorite (7%), and within these major phases minor variants can be recognized which range in composition from leucogranite to meladiorite. Part of the quartz monzonite has been hydrothermally altered with the formation of veins of quartz and pyrite, but without the formation of economic minerals deposits. Quartz diorite, which occurs on the border of the pluton, has an aureole of alteration composed of chloritic quartz diorite in which scheelite is locally present in economic amounts. There is a wide range in textures in the pluton and an unusual textural feature, designated as the "granitic intergranular," occurs principally near the borders of the quartz monzonite but is also found within it.

Interpretative evidence favoring the magmatic origin

of the pluton is not evident. The border textures and structures suggest that metasomatism has been an important process in forming the pluton. The quartz diorite is identified as a basic front. The writer concludes that the pluton was probably formed by replacement.

Microfilm \$2.80; Xerox \$9.60. 214 pages.

#### MUSIC

SUSANNE LANGER'S MUSIC AESTHETICS.

(L. C. Card No. Mic 59-3786)

Fred Blum, Ph.D. State University of Iowa, 1959

Chairman: Professor Albert T. Luper

Music plays the central rôle in Susanne K. Langer's aesthetics. She devotes considerable space to music (see especially Philosophy in a New Key, Harvard University Press, 1942, Chapters VIII and IX, and Feeling and Form, Charles Scribner's Sons, 1953, Chapters VII-X). While her treatment of the symbolism of language, ritual, and myth parallels Ernst Cassirer's explicit statements, she goes beyond Cassirer in applying the philosophy of symbolism to music. Finally, using music as her starting point, she generalizes her theory of musical significance to the other arts.

This study considers some of the consequences of three of Dr. Langer's philosophical premises for her aesthetics in general and her music aesthetics in particular. Chapter I formulates her epistemological assumption that all knowledge (including aesthetic insight) initially rests upon intuition, her "logical" premise that the correspondence theory of knowledge may be extended perhaps metaphorically to account for musical as well as linguistic meaning, and her teleological premise that man's inherent "need of symbolization" determines the modes of his activities and the nature of his works.

Chapters II, III, and IV expound and criticize Langer's notions of music's semblance, symbol, and import in the light of her premises. According to the notion of semblance, the work of art is an "apparition" given only to aesthetic perception. Each art is characterized by its particular primary apparition: painting by virtual space; music by virtual time. Langer's semblance separates the aesthetic domain from the physical and causal orders and the conative self in a way which may be compared to Edward Bullough's "psychical distance."

Langer distinguishes between discursive (e.g., linguistic) and presentational (e.g., musical) symbols. She extends the correspondence theory to account for the import of presentational symbols. Objections to the correspondence theory itself, to Langer's distinctions between language and music, and to the extension of the

correspondence theory itself, to Langer's distinctions between language and music, and to the extension of the correspondence theory to presentational symbols are considered. Notably, it is argued that Pratt's theory of isomorphism explains how music may have objective import without assigned connotation. It is suggested that the apparent contradiction between Langer's epistemological and logical premises, i.e. between the "immediate" intuition of the art object and the "mediation" of the art

symbol, may result from an ambiguous use of the term "mediation."

On the basis of her teleological premise, Langer distinguishes in kind between signal and symbol behavior. Special attention is given to her formulation and rejection of "self-expression" theories of musical import, which she equates with signal behavior, in favor of her own "logical" or symbolic expression theory. It is concluded that according to Langer music symbolizes actual, but not necessarily experienced, emotion by formal analogy.

Chapters V and VI deal with the distinctions between the musical symbol and the symbol in music and with the relations among the arts, respectively. Such symbols in music as Affektenlehre, programmatic devices, and programs are assimilated to the musical symbol, thereby contributing to its formal structure and expressive import. Rejecting the cliché that song results from the marriage of music and poetry, Langer insists that music also assimilates poetry and drama in song and opera.

The following chapters investigate the implications of Langer's teleological premise for her theory of the origin and history of music. Instead of emphasizing music's antecedents, material source, or genesis, Langer turns to the origin of musical import. Music originated when proto-musical materials were first adapted to musical functions. Although styles and traditions change, music's function remains the same throughout history.

Despite frequent attacks on Langer's mentalistic, gestaltist, and idealistic tendencies by behaviorists and positivists, musicians will continue to turn to her analysis of musical significance for an answer to the question: What does music mean?

Microfilm \$5.90; Xerox \$20.60. 462 pages.

THE SETTING OF POETRY IN THE ENGLISH MADRIGAL WITH AN EDITION OF THE TEARES OR LAMENTACIONS OF A SORROWFULL SOULE.

(L. C. Card No. Mic 59-2812)

Robert Barney Childs, Ph.D. Stanford University, 1959

The English madrigal is held to have grown through the fusion of the two highly developed and sophisticated genres of imitazione della parola, in music, and the classical tradition of rhetorical principles, expanded and decorated by the Renaissance, in language. The appearance of each of these traditions in recognizable forms in the madrigal is demonstrated: the poem set may deal with one of a number of traditional subjects in a variety

of ways conditioned by rhetoric, and the musical setting may use several organizational and decorative devices "illustrating" the words. Each of these traditions has an extensive historical background, but the peculiarly individual nature of English lyric verse and English madrigal music is assumed to depend much more on what the English composers and lyricists did with Italian tradition than on Italian tradition itself. The lyric writers, influenced by the short rhymed Latin lyric of earlier centuries and by the teeming controversies of their time on literary and linguistic matters, produced a bewildering variety of poetic forms to contain the rhetoric, and the composers, guided by the individual and special nature of English language and metrics, gave the expiring Italian tradition new freshness and life. Verse and music were interactive. The demands of technique in setting a poem to imitative polyphony established the madrigal test as a short-line verse form generally of formulary content, and the richness and imagery cultivated in the verse through skillful use of rhetoric, in combination with the "monosyllabic" nature of English and the systematizing of English metres, shaped the musical structure of the madrigals, both in separate voice-line and in over-all arrangement.

This dissertation presents an investigation of the particular natures of both the music and the poetry of the madrigals and devotes a chapter to analysis of complete compositions. The poetry is discussed in terms of metrics, rhetoric, and linguistics. A system of barring has been used for the music which reveals clearly the prosody of each musical line, each individual voice, in its relation to the ensemble as a whole as well as to its own implications as a part of a coherent unity. An analysis of varying settings of similar words in The Triumphs of Oriana helps to complete an inclusive definition of English madrigal style. The placement of a poem within a musical structure alters the effect of the poem, and this alteration may more or less interfere with a listener's complete comprehension of the poem. The efficacy of the setting of a poem depends upon the skill of the composer in matching and balancing the conventions of music and poetry so that the gain in emotional appeal and illustrative power provided by the musical setting offsets as effectively as possible the loss in accuracy of communication inherent in the change of metrics and sound caused by the placement of the poem to music. By the nature of the madrigal as a permutation of musical material and poetic and rhetorical material well-known to the listener of the time, the completed composition achieves a precision of matching text to music that has not since been equalled in serious song.

The first complete edition of The Teares or Lamentacions of a Sorrowfull Soule, both vocal music and tablatures, has been prepared by the author and included as an appendix, with comment on the application of the musical devices of the time to sacred and secular texts alike and with a short discussion on the nature of accompanied ensemble song. This edition, prepared using the system of barring mentioned above, has been freely drawn upon to provide illustrative examples for the body of the dissertation. Another appendix furnishes several pages of a madrigal comparing Canon E. M. Fellowes' scheme of barring to that used by the author, and a third suggests a solution to Fellowes' mistakes in transcribing changes of "time-signature" in his edition of the madrigals. Every

effort has been made in preparation of the Teares to furnish an edition that may be used for actual performance. Microfilm \$6.45; Xerox \$22.20. 505 pages.

THE EVOLUTION OF THE FANTASIA AND WORKS IN RELATED STYLES IN THE SEVENTEENTH-CENTURY INSTRUMENTAL ENSEMBLE MUSIC OF FRANCE AND THE LOW COUNTRIES.

(L. C. Card No. Mic 59-2440)

Albert Cohen, Ph.D. New York University, 1959

Adviser: Professor Gustave Reese

The seventeenth-century French fantaisie for instrumental ensemble was essentially derived from the vocal motet of the Renaissance by way of the improvised polyphonic French organ fantaisie of the late sixteenth century. The primary aim of the written-out fantaisie was pedagogical. It served principally as a means through which to study composition and the basic tools of music. Furthermore, it provided a means of maintaining one's instrumental technique and of tuning and of otherwise preparing an instrument, as well as the musician, for performance. Fantaisie, as a term, was used to designate a piece in any free instrumental style. It continued to serve as a leading improvisational style throughout most of the French Baroque and provided the basis for many of the free instrumental types of the French suite.

The fantaisie appears to have been the only purely instrumental type performed in the essentially vocal private concerts given by the Académie under the direction of Mauduit. The instruments employed in these concerts were primarily those capable of supporting a bass part, and the viol was especially favored. Only the viols are known to have been used as a family to perform ensemble music or to double the voices in part music in French private concerts before ca. 1660. Viols performing in groups were normally combined with other instruments, keyboard instruments being preferred to other types as auxiliaries. During the last third of the seventeenth century, instruments employed in court and public activities came to be used in private concerts, the majority of which reflected the tastes of the dilettantes and amateur musicians who principally gave and attended

French polyphonic fantaisies were written, for the most part, by musicians who strove to maintain the traditions of Renaissance polyphony during the seventeenth century. Examples of the type generally are in a motetlike style and employ pervading imitation. They are usually monothematic, being at times based upon preexistent material, and occasionally comprise several contrasting sections. Also, they often display the composer's interest in particular techniques or musical elements such as degree inflection, the interval of the fourth, or the modes. During the second half of the century the fantaisie as a type for instrumental ensemble lostfavor in France, and the term fantaisie came to designate a suite movement written in a dance style. Examples of this

type for ensemble are sectional in structure, have a firm harmonic foundation, and often employ imitation.

Composers of instrumental ensemble music in the Low Countries appear to have shown little interest in the free types before ca. 1650. After this date it was the canzone that became the favored free type of an important literature for ensemble that appeared in the Netherlands, and the term fantasia was but one of many used to designate a composition in any free instrumental style. In the Dutch ensemble production, in which preference is shown for instruments appropriate to the tastes of the musical amateurs for whom it was primarily designed, there appears to be little or no direct relationship between the types of music performed and the combinations of instruments used to play them. The few extant seventeenthcentury Dutch fantasie for instrumental ensemble manifest both Italian and French influences; the works generally consist of several contrasting sections, reveal a strong feeling for tonality, and employ imitation.

Microfilm \$3.90; Xerox \$13.20. 304 pages.

THE PIANO SONATAS OF SERGE PROKOFIEFF:
A CRITICAL STUDY OF THE ELEMENTS
OF THEIR STYLE.

(L. C. Card No. Mic 59-3113)

David Leslie Kinsey, Ph.D. Columbia University, 1959

Chapter One discusses the historical context of Prokofieff's Piano Sonatas: his predecessors of the 19th Century and his contemporaries of the 20th Century.

The Sonatas are then analyzed in detail in Chapters Two and Three, each movement separately, with numerous illustrations and analytical sketches.

Matters of style are discussed in Chapter Four:

(A) Technical Elements, (B) Characteristics, (C) Evolution of Style, and (D) Problems of Style. Prokofieff's use of form is found to be traditional. Cyclical relationships occur frequently between movements. Melodies of the early sonatas frequently use step-progressions, but the later works almost never. The distortion in Prokofieff's melodies is seen to result from octave displacement,

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unexpected resolutions, "side-slipping", and foreign tones. The harmony adheres to the tertian system, with dissonances resulting chiefly from melodic lines. Parallelism, consecutive major thirds, whole-tone melodic lines (but never whole-tone harmony), abrupt modulation, and fragmental polytonality are features. Though not a contrapuntist, Prokofieff frequently uses augmentation, imitation, and occasional mirroring. The composer's own percussive pianism is reflected in his driving rhythms, explosive dynamics, and clear textures.

Prokofieff is shown to have owed little to his European predecessors in his sonata form. He did not follow Liszt's innovations in form. His classicism is nearest to Beethoven. Prokofieff eliminated lush textures, impressionistic mists, eroticism, and mysticism, substituting new concepts of vitality and texture. It seems impossible to ascribe influence to specific individuals or schools, and it is shown that he could have taken his ideas from various sources. His early innovative tendencies gave way in the 1930's, to a change of convictions, and the later sonatas show a return to romanticism in the slow movements, a simplification of techniques, and increasing lyricism. The question of the effect of Soviet ideology upon the style of the Piano Sonatas is discussed, and the conclusion is reached that Prokofieff was ready by the turn of his own convictions for the very ideas championed by Soviet policy, and that any attempt to prove more seems reduced to speculation.

The Piano Sonatas can not be said to belong to a single style; they embrace neoromanticism, neoclassicism, and some modernism. The variety of styles poses a problem of organic unity in the later Sonatas, and it would seem that the composer was not completely successful in solving this problem.

Chapter Five undertakes an evaluation of the Sonatas individually, and discusses Prokofieff's contributions to the piano sonata. These contributions are fourfold: (1) he pioneered the return of clarity of form, of texture, and of tonality; (2) he introduced the modern style mécanique; (3) he was the first 20th Century composer to introduce sarcasm and grotesquerie into a form often reserved for imperious pronouncements and heroic emotions; and (4) he contributed several modern sonatas, gratifying to perform and palatable to the public.

Microfilm \$4.15; Xerox \$14.00. 323 pages.

#### PHARMACOLOGY

EFFECTS OF THREE CARDIOACTIVE STEROIDS ON CONTRACTION AND MEMBRANE POTENTIALS FROM ATRIAL AND S-A NODE CELLS OF ISOLATED RABBIT ATRIA.

(L. C. Card No. Mic 59-3331)

Joseph Victor Levy, Ph.D. University of Washington, 1959

Chairman: Theodore C. West

The thesis describes the effects of three steroids. strophanthin-G (ouabain), 3-acetyl strophanthidin and RO 2-7302/4 (17-(2-piperidylmethyl)-3 $\beta$ , 17 $\beta$ -androstanediol lactate hemihydrate on the electrical and mechanical activity of spontaneously beating isolated rabbit atria. Mechanical activity (contraction of combined right and left atria) was measured isometrically by strain gauge methods. Electrical activity was recorded with glass capillary microelectrodes either from cells of the right atrium proper or from the area of the sino-atrial node, the normal cardiac pacemaker. Alterations in contraction and the configuration and/or timing of membrane potentials under the influence of the drugs employed were compared with control recordings. The experiments were done at temperatures of 23-30° C and at the spontaneous rate of beating characteristic for the preparation under the conditions used.

With the drug concentrations studied, both ouabain and 3-acetyl strophanthidin were shown to decrease contraction amplitude of the atria and decrease the duration and amplitude of atrial membrane action potentials to the point where atrial asystole occurred. Membrane resting potentials were also progressively decreased. Rhythmic pacemaker discharge from the cells of the pacemaker region was not greatly affected. Atrial asystole was associated with a significant reduction in the value of the membrane resting potential.

Contraction amplitude was found to be variably affected by RO 2-7302/4 depending on the drug concentration used. The duration of atrial membrane action potentials was always increased while action potential amplitude was little or only slightly reduced from pre-drug values. These effects on the atrial myocardium were found to be similar to the actions of quinidine and related drugs.

The persistence of rhythmic pacemaker discharge during ouabain and strophanthidin-induced asystole suggests that there is a basic difference in the processes underlying the electrical events in the cardiac pacemaker. The results offer electrophysiological confirmation of previously demonstrated differences in the susceptibility of atrial and S-A nodal tissue to the actions of the cardiac glycosides.

A structure-activity relationship was found in the comparative responses to RO 2-7302/4 and the two strophanthus derivatives. The former agent differs from ouabain and 3-acetyl strophanthidin chiefly by the absence

of an unsaturated lactone ring in the C-17 position of the steroid nucleus. The data suggests that the lactone moiety is a necessary structural requirement in producing the effects on membrane potentials characteristically seen with the administration of cardiac glycosides.

The effects of the drugs were discussed in terms of current concepts of the ionic and biochemical events underlying the electrical activity of cardiac tissue. It is proposed as a working hypothesis that the differential effect of ouabain and 3-acetyl strophanthidin on atrial and pacemaker cells may be related to the demonstrated differences in the acetylcholinesterase activity of these two areas of the heart. The hypothesis best explaining the effects on atrial membrane activity is that the cardiac glycosides interfere with the generation and propagation of action potentials by selectively interfering with the transport of sodium and potassium across the cell membrane.

Microfilm \$2.00; Xerox \$4.20. 80 pages.

#### BIO-ASSAY OF PARATHYROID EXTRACT.

(L. C. Card No. Mic 59-1787) Delmar James Mahler, Ph.D. University of Nebraska, 1959

Adviser: A. R. McIntyre

The idea that the parathyroid gland elaborates more than one physiologically active substance is of interest. Should such a concept prove true it might provide an explanation for the presence of several types of secretory cells in the parathyroid gland itself and perhaps would account for the known actions of parathyroid extracts on the kidney and bones. Investigations attempting to test this hypothesis have been severely hampered by a lack of suitable methods. The present study is chiefly concerned with two methods which are expected to fill the need for precise and specific methods.

These methods consist of two separate procedures for the biological assay of parathyroid extracts. One method is based on the increase in serum calcium of mice 24 hours after subcutaneous injection of parathyroid extracts. The second method is based on the decrease in mouse blood inorganic phosphorus 3 hours after subcutaneous injection of parathyroid extracts.

Normal mice were used in both assay methods. Parathyroidectomy or special diets were not necessary to enhance the sensitivity of the animals. This makes handling and caring for the test animals a very simple task.

The two methods developed in this study offer a relatively economical means of assaying parathyroid extracts. The total number of analytical determinations required were 56 and 72 for the calcium and phosphorus assays

respectively. These totals are smaller than those required by other methods which have a similar degree of precision.

The proposed assays were found to be highly sensitive measures of the activity of parathyroid extracts. In order to produce a significant increase in serum calcium, doses of 0.0057 to 0.0226 milliliter of U.S.P. Parathyroid per gram body weight were administered. Doses for the assay based on the phosphorus activity were from 0.00075 to 0.003 milliliter of U.S.P. Parathyroid per gram body weight. The quantities of parathyroid extracts necessary for carrying out assays of unknown preparations by these methods were equivalent to 7.5 and 1.2 milliliter of U.S.P. Parathyroid for the calcium and phosphorus assays respectively.

Sample assays were carried out and their results presented. The estimated potencies as determined by the calcium method differed from the theoretical potency no more than 9 to as little as zero per cent. The estimated potencies determined by the phosphorus method varied from their theoretical values by not more than 13 and as little as 2 per cent. These potency estimates represented a degree of precision equal to or better than that attained by any other method that has been published.

Microfilm \$2.00; Xerox \$4.00. 72 pages.

A STUDY OF THE DISTRIBUTION OF THALLIUM IN TISSUES, BLOOD, URINE AND FECES.

(L. C. Card No. Mic 59-3366)

Arnold Louis Pritschow, Ph.D. The University of Oklahoma, 1959

Major Professor: H. A. Shoemaker

A method is presented for the determination of thallium in urine, feces, blood and tissues. It is based upon the destruction of organic material by ashing with sulphuric and nitric acids, and precipitation of the thallium as a thallium-bismuth iodide complex, (TII)<sub>2</sub>. BiI<sub>3</sub>. The precipitate is separated by centrifuging, and is then washed, first with water and then with alcohol. The complex is oxidized with bromine in glacial acetic acid, and then sodium formate is added to form a formate-acetic acid buffer which inactivates the excess bromine. The thallium in the complex is determined by iodometric titration. Antimony, arsenic, copper, iron, lead, mercury and tin do not interfere.

The distribution of thallium in the urine, feces, blood and tissues was determined after acute poisoning by constant intravenous infusion of thallium (I), and after chronic poisoning by the daily administration of thallium (I) orally.

In the experiments designed to show acute poisoning, two dogs were infused, one at the rate of 1.75 mg. Tl+/kg./min., and one at the rate of 1.0 mg. Tl+/kg./min. Although the rate of thallium infusion was different, the animals died after the administration of 245 mg. Tl+/kg./min., and 253 mg. Tl+/kg./min., respectively.

In the experiments designed to show chronic poisoning, 5 mg. Tl<sup>+</sup>/kg./day was administered orally in gelatin

capsules to two dogs. These animals died on the seventh and eighth days after receiving a total amount of 35 mg.  $Tl^+/kg.$ , and 40 mg.  $Tl^+/kg.$ , respectively.

Thallium was found in the urine of the acutely intoxicated dogs within twenty minutes after the infusion of the thallium was started, and in the chronically intoxicated dogs, it was found in the urine from the third day until death.

Thallium was found in all organs and tissues analyzed except hair and bone in the acutely poisoned animals, and hair in the chronically poisoned animals. The more vascular organs were found to contain the largest amounts of thallium in acute poisoning. The distribution of thallium was not uniform in the chronically poisoned animals, but the range between the organs containing the most and the least amounts of thallium was not great.

Microfilm \$2.00; Xerox \$3.00. 58 pages.

INHIBITION OF THE ACTION OF CERTAIN STEROID HORMONES BY A DERIVATIVE OF SYMMETRICAL TRIAZINE.

(L. C. Card No. Mic 59-3235)

Harold Emanuel Williamson, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor F. E. Shideman

PART I. ANTAGONISM OF THE EFFECTS OF CER-TAIN STEROIDS ON THE RENAL EXCRETION OF WATER AND ELECTROLYTES BY 2-AMINO-4-(p-CHLOROANILINO)-s-TRIAZINE

The mechanism of the diuretic action of 2-amino-4-(pchloroanilino)-s-triazine was studied in the rat. Following an oral load of isotonic NaCl (50 ml/kg) the triazine, 1.25-5 mg/kg administered intraperitoneally in saline, produced diuresis, natriuresis, chloruresis and retention of potassium. After an oral load of water (50 ml/kg) natriuresis and chloruresis persisted but antidiuresis and no change in potassium excretion were observed. Similar results were obtained with hypophysectomized animals if normal handling of such loads was restored by administration of cortisone. This would appear to rule out the antidiuretic hormone as the mediator of the antidiuresis and suggests that an inhibition of steroid handling of such loads is involved. The lack of a natriuretic effect of the triazine in adrenalectomized rats and its ability to reverse Na retention induced by mineralocorticoids suggests that the natriuretic action of this drug is due to inhibition of reabsorptive mechanisms for Na which are regulated by the adrenal steroids. The reduced excretion of K in adrenalectomized animals suggests that a factor, other than antagonism of steroid action, operates with respect to the effect of the triazine on the renal excretion of this cation. A suppression of the distal tubular secretion of K would appear to be involved since the triazine decreased K excretion when administered after acetazoleamide or orally administered KCl.

PART II. INHIBITION OF GLYCOGENIC, MYOTROPHIC AND ANDROGENIC ACTIVITY OF CERTAIN STEROIDS BY 2-AMINO-4-(p-CHLOROANILINO)-s-TRIAZINE

The capacity of 2-amino-4-(p-chloroanilino)-s-triazine to antagonize the renal mineralocorticoid effects of desoxycorticosterone and  $9\alpha$ -fluorohydrocortisone on the urinary excretion of sodium and potassium raised the question as to whether or not this compound could also affect other actions of hormonal steroids.

Glycogenic activity was measured by corticoid induced deposition of hepatic glycogen in starved adrenalectomized rats. This response was significantly inhibited by administration of the triazine when either hydrocortisone or  $9\alpha$ -fluorohydrocortisone was employed to induce the deposition. Stored glycogen was not affected indicating that only the steroid induced deposition was blocked. The inhibition was determined to be reversible and competitive suggesting that the triazine antagonizes glucocorticoids at their peripheral site(s) of action. Inasmuch as chlorothiazide, another diuretic agent, did not affect corticoid induced hepatic deposition of glycogen the loss of sodium and water per se would not appear to be involved in this inhibition. A possible site of action for this inhibitory action could be on corticoid induced accumulation of amino acids by the liver. Christensen has reported that the glucogenic actions of hydrocortisone could be explained on this basis. Inasmuch as the triazine derivative was also found to inhibit this response, its antagonism of glycogen deposition could also be explained on this basis.

The myotrophic action of testosterone propionate and 17-ethyl-19-nortestosterone was also inhibited by the triazine. Androgenic activity however, was affected only in the case of testosterone. No effect was found on the estrogenic activity of estradiol or the anti-inflammatory activity of hydrocortisone. The lack of effect on the latter suggests that receptor sites for this activity and glycogenic activity are different.

# PART III. THE TOXICITY OF 2-AMINO-4-(p-CHLORO-ANILINO)-s-TRIAZINE

2-Amino-4-(p-chloroanilino)-s-triazine was synthesized to overcome the toxicity of formoguanamine. However, little information has appeared in the literature with respect to the toxicity of this new compound.

The oral LD<sub>50</sub>'s of three samples of this compound were determined in the rat. These were found to range from 18.3 mg/kg to 580 mg/kg. The reason for these differences was not apparent. The short term chronic toxicity of the most toxic sample did not appear to be different from its acute toxicity. In the mouse the LD<sub>50</sub> of this sample was 91 mg/kg by the intraperitoneal route. In the dog short term chronic toxicity studies with the same sample indicated that the oral administration of 50 mg/kg per day for two weeks was well tolerated.

At autopsy, the only changes noted involved the kidneys which were enlarged and pale. Histological studies revealed that pathological changes induced by this agent were limited to the kidney and consisted of tubular necrosis.

Microfilm \$2.00; Xerox \$5.40. 108 pages.

### PHILOSOPHY

EMPIRICISM AND GEOMETRY IN HOBBES AND LOCKE.

(L. C. Card No. Mic 59-3100)

George Goe, Ph.D. Columbia University, 1959

This study, which developed in connection with the preparation of a work on geometry and empiricism in general, centers around the account of geometric knowledge given by Hobbes and Locke.

In the introductory part of the work it is indicated how in philosophical tradition, and up to recent times, geometry was the a priori science par excellence, the inspiration of rationalistic philosophers, the proof of the possibility of the kind of knowledge that the latter were seeking.

In the second and third parts of the dissertation the inquiry is made of how Hobbes and Locke confronted the problem of accounting for geometric knowledge within an epistemology which originally or in intent was empiricistic.

Hobbes — it is found — anticipates logical empiricism in stressing the importance of theory construction and deductive reasoning while regarding all necessary propositions as analytic. Geometry, for him, is necessarily

true only because its propositions are obtained by tautological transformations from arbitrary definitions. In a vain attempt to reconcile such a view of geometry and other hypothetico-deductive sciences, as mechanics, with their predictive capacity, he assumes that the definitions of terms in such disciplines stipulate how the objects denoted by such terms are to be constructed, thus allegedly deductively relating a cause (the construction of an object) to an effect (the properties of the object constructed).

Hobbes's own endeavors in geometry proper were a complete failure, followed by inane controversies.

Locke was temperamentally more empirically minded than Hobbes. His Essay appears as a development from a basic epistemology according to which all knowledge is derived from, and is certified by, sense-experience — a view explicitly expounded in earlier drafts of the work. Locke is at a loss, however, to account, in this fashion, for our knowledge of geometric propositions, which he regards as certain and yet "instructive," i. e. synthetic. The author is thus brought to accept the existence of some synthetic a priori propositions. But this rationalistic element in his epistemology, not only is combined with a complete rejection of innatism, but radically differs from traditional forms of rationalism in other respects also. For Locke, geometrical propositions are discovered in

the contemplation of particular diagrams, and are then seen to hold for all possible perceived or imagined diagrams — a clear anticipation of Kant's doctrine of geometry as the necessary form of our sensibility.

Locke's idea-ism, his view of thinking and knowledge as being concerned with sensual images, is taken over, and held to thoroughly — is observed in the fourth part of the dissertation — by Berkeley and Hume. The former does not seem to consider, within this framework, the kind of knowledge that we have in mathematics and notably geometry as constituting an epistemological problem. Hume, on the other hand, does not accept synthetic a priori knowledge, and hesitates as to whether geometry is synthetic and uncertain or certain and analytic. His analysis of the question is wanting.

Also Kant's doctrine, with its emphasis upon the distinction between the analytic and the synthetic, and with its sensualistic account of geometric knowledge, clearly reveals the pervading influence of Locke on sub-

sequent thought.

In the final section of the dissertation it is briefly noted that the technical developments in geometry of the nineteenth century have shown not only that geometries inconsistent with Euclidean geometry are self-consistent, but also that our mind can learn to view such alternative geometries as descriptions of relations among physical bodies that are quite conceivable, and may actually hold to the extent compatible with our everyday observations.

Microfilm \$4.25; Xerox \$14.20, 330 pages.

COMMUNITY, COVENANT, AND REASON: A STUDY IN JEWISH LEGAL PHILOSOPHY.

(L. C. Card No. Mic 59-3101)

Martin Philip Golding, Ph.D. Columbia University, 1959

The purpose of this study is to expound and analyze the rabbinic treatment of three important topics of Jewish legal philosophy: (1) the conception of the Jewish community; (2) the grounds of the obligation which Jews have to obey Jewish law; and (3) the theoretical basis of the activity of the jurist in expanding the law. An understanding of the rabbinic treatment of these topics is essential for an understanding of Jewish law itself. The primary source materials which are utilized are the juristic writings of the rabbinic tradition, in which are found numerous statements bearing on these issues. The legal import of the philosophical materials is stressed throughout this essay.

The society of Jews is conceived of as an indissoluble and organic social group with supernatural characteristics. This conception is compared with the mediaeval conception of Christendom as a corpus mysticum. The organological analogy which was important in mediaeval Christian political discussion is not found in Jewish thought; the conception of Israel as a mystical body is found to be important in two areas: (1) in a philosophy of history, and (2) in providing a notion of legal status. God is viewed as having created the eternal Community by giving the Jews his Law. Representative views as to the basis of God's election of the Jews are discussed, namely,

whether this was an act of Divine Grace or Divine Reason. The legal effects of the idea of the Community as composed of members who are indissolubly bound to it and to the Law is traced through numerous examples of the legal effects of the change in legal status produced by the act of conversion.

The rabbinic treatment of the role of the Jews in becoming obligated to the Law is then expounded. The key concept here is that of Covenant, a covenant in which each individual Jew accepts the "yoke of the commandments" and a concern and responsibility for the obligation which other Jews have towards the Law. The subtile relationships between this acceptance and the acceptance of the "yoke of the Kingship of Heaven" is traced in great detail. The latter is identical with the recognition of God's existence, the former following from it as a virtual logical consequence. In spite of the voluntary acceptance of the Law by the Jews, it is the imposition of the Law upon them which guarantees the permanent binding-force of the "covenant of responsibility." The role of voluntary consent in the theorizing of the mediaeval jurists concerning the basis of local government is then treated and is related to the original "covenant of responsibility."

Just as they viewed the Community of Israel as God's creation, so also did the rabbis conceive the Law as God's creation. This provided a theoretical basis for the expansion of the Law through reasoning and argumentation, for God is viewed as having created a body of legal concepts which may be analyzed and compared so that the jurist may indefinitely proliferate the scope of the Law. This view of the Law is called "halakhic conceptualism" and is analyzed in great detail with many examples of juristic argumentation. The striking feature of rabbinic legal theory is the recognition of the inevitability of disagreement among the legal experts in the juristic expansion of the Law. Various methods for securing legal certainty are treated.

It is argued that a study of the sort conducted in this dissertation, which examines the intellectual framework of a legal system, is a necessary part of the philosophical analysis of law.

Microfilm \$3.30; Xerox \$11.40. 256 pages.

A LOGICAL ANALYSIS OF TOLMAN'S THEORY OF LEARNING.

(L. C. Card No. Mic 59-2638)

Joseph Frederick Lambert, Ph.D. Michigan State University, 1958

The purposes of this essay are two-fold. First, it will present a logical, or formal construction of Tolman's theory of learning. The construction to be offered in this essay is restricted, by and large, to that version of Tolman's theory as explained and illustrated in his book, Purposive Behaviorism in Animals and Man. However, in the formal development of Tolman's theory an attempt will be made to derive certain versions of the so-called latent learning principle. The latent learning issue has its beginnings in the Blodgett experiment of 1929; the experiment is discussed in Purposive Behaviorism. It is still a burning issue today. The importance of the latent

learning experiments for Tolman's theory of learning cannot be underestimated. For they are generally taken to be the most important of the many experiments which constitute the empirical foundations of Tolman's theory of learning. Investigators have questioned whether (in fact) they can be deduced from Tolman's theory and hence are in doubt as to whether they constitute a test of Tolman's theory of learning.<sup>3</sup> The system in this essay shows that at least some of them are deducible from Tolman's theory.

Secondly, it will present a critical appraisal of Tolman's theory of learning. This appraisal is initiated by the problems which arise in the formal construction of Tolman's theory. The appraisal is largely methodological in scope; in general, it does not deal with empirical or experimental issues. Nevertheless, to a certain extent, these methodological points derive their plausibility from experimental sources, for example, the latent learning issue.

Finally, it should be understood that the formal system to be developed in this essay is not a complete construction of Tolman's theory. Time and space are invulnerable enemies; especially when one is working in uncharted surroundings. The present system though incomplete is more than programmatic. This, I trust, will become clear in the ensuing pages.

Microfilm \$2.90; Xerox \$10.00. 223 pages.

- 1. Tolman, E. C., Purposive Behaviorism in Animals and Men, University of California Press, 1932 (Reprinted in 1951).
  - 2. Ibid., pps. 48-50.
- 3. Meehl, P. and MacCorquodale, K. "Edward C. Tolman", in Modern Learning Theory, Appleton-Century-Crofts, 1954, pps. 127-266.

#### PAUL TILLICH'S INTERPRETATION OF HISTORY.

(L. C. Card No. Mic 59-3124)

William Wright Paul, Ph.D. Columbia University, 1959

We bring together and evaluate Paul Tillich's contributions to a religious and social philosophy of history in four basic areas: (1) historical methodology, (2) the question of "significance" in history, (3) a social theory of the "present situation," and (4) an existential-theological interpretation of history.

Tillich describes history as "the totality of remembered events which are determined by free human activity and are important for the life of human groups." His tendency is to place history over against "nature" and to seek to uncover the meaning of his heritage by "participative awareness." We have argued that cognitively this "method" raises difficulties which would make it a poor substitute for a broadly conceived scientific method for investigating any past. Tillich is, however, able to stress the value of social participation in the vocation and power of human groups which are the "bearers of history." His theory could profit from greater attention to the plurality of problems faced in a past and to the institutional methods for meeting them. Tillich's theory of freedom for self-

determination through destined limits allows for political and economic activity, although he personally takes the church to be pivotal for the actualization of meanings and values.

Tillich's theory of "significance" hinges on his belief that human freedom and destiny (including "divine" forces) may conjoin to create a kairos, a right moment in which "natural-clock time" becomes "meaning-giving historical time." On this dichotomy rests Tillich's distinction between "nonhistorical" and "historical" types of interpretation of history. The latter is one in which events are viewed as moving from a Center of history toward new fulfillments and in which some "demonic" tendencies in individuals and groups are overcome in the "history of salvation." Here Tillich is more of a prophet of the "signs of the times" than an interpreter of the past. He rather monistically seeks out the key problem, the "style" and religious significance of past and present eras. More suggestive is his theory of secondary kairoi for meaningful historical action.

The "present situation" for Tillich is the post-1914 world in which the meaningfulness of history is in doubt. We raise questions about his analysis of "bourgeois society" and his existentialist-prophetic adaptation of Marx. In both Germany and America Tillich's expected kairos failed. Rather than American "activism" and a willingness to work for relatively adequate goals, Tillich has concentrated rather negatively on the trends to be resisted. His whoistic approach to man's problems now leaves him "waiting in a vacuum" for a new time of opportunity. We have argued that his long-term ideals need translation into timely directional signals for working through our institutions to meet our pressing problems in positive and intelligent, as well as passionate and principled, ways.

Existentialism is a way of stating "problems" concerning man's "estranged existence," and with them Tillich seeks to correlate his own theological-symbolical "answers": Creation-Fall, New Being or Center, and the Kingdom of God as the Aim of history. The myth of the Fall is used to get men to "see" some theological significance in the apparent meaninglessness and disruptedness of their existence. The Center and Outcome symbols are supposed to suggest the resolution in principle and by expectation of this predicament. As for the Central Kairos, we have shown that Tillich is not fundamentally concerned about a historical Jesus but with a "Christ of faith" as a religious meaning-giving center of history. He uses symbols to make the past "contemporaneous" and to stimulate the faithful in the Church to "fight" against "demonic" forces and for the Kingdom of God in history. Again, what Tillich needs most is to correlate his idealized-End with definite social programs and with the complexities of actual history.

Microfilm \$3.80; Xerox \$12.80. 294 pages.

#### A CRITICAL ANALYSIS OF THE THEORY OF ANALOGY OF ST. THOMAS AQUINAS.

(L. C. Card No. Mic 58-7663)

James Francis Ross, Ph.D. Brown University, 1958

This thesis contains: the results of an analysis of the writings of St. Thomas Aquinas (1225-1274) to determine the nature of his 'theory of analogy'. The material is divided into 1) an explanation of the theory in language intelligible to contemporary philosophers; 2) a philosophical critique designed to isolate the assumptions of the theory and to formulate salient difficulties both with the general philosophical assumptions of St. Thomas and with the sufficiency of the analogy-theory for the purposes of St. Thomas.

The thesis is divided into five Chapters, the first a general introduction in which important definitions are formulated; the second, an explanation of the 'analogy of inequality'; the third, an explanation and choice of interpretations of 'analogy of attribution'; the fourth, an explanation and formulation of the definitions of 'metaphorical analogy' and 'analogy of proportionality' with an analysis of various interpretations of the theory; the fifth, a combination of explanation and criticism of analogy as a theory of language about God. A brief conclusion gives a propositional summary of the thesis, summary of difficulties within the theory, a summary of difficulties with the assumptions of the theory, and a brief statement of issues raised by the analysis. There are two appendices, one containing the relevant latin texts of St. Thomas, the other containing the list of definitions formulated throughout the thesis.

The thesis treats analogy as a theory about language, showing that the analogy-rules of St. Thomas were supposed by him to conform to the practice of ordinary discourse and to offer a useful way of constructing philosophical language. This claim that 'analogous' is a term which applies to terms, and only by extension to things, is supported by citations from and analysis of the texts of St. Thomas, even though such an interpretation does not accord with the analyses of his more eminent interpreters.

Other distinguishing features of this analysis, with respect to which it differs from previous interpretations of St. Thomas, are as follows.

- 1. Definitions are formulated for each of the kinds of analogy. These definitions are shown to be in accord with and implied by the general philosophical assumptions of St. Thomas.
- 2. The analogy of proper proportionality is shown to be a theory concerned with the employment of relation-terms.
- 3. There is no direct analogy of attribution by which terms taken from the world of experience are directly used to attribute properties to God either envisioned by St. Thomas or possible as an independent theory of language about God.
- 4. All terms in statements about God are shown to be analogous by proper proportionality, and some are shown to be further analogous by attribution.
- 5. The theory of analogy of proper proportionality is shown to rest upon three unproved assumptions: a) that the intentions of terms contain two different kinds of terms, quiddative and modal; b) ordinary language is an

indisputable criterion of informative discourse and it is the practice of ordinary language to make 'transcendentally' general statements; c) there are at least some things which are no more than proportionally similar to other things, i.e., there are irreducible categories of things.

6. The interpreters of St. Thomas such as Penido, Garrigou-Lagrange and Anderson have made the theory of analogy unintelligible.

- 7. St. Thomas' theory of analogy does not avoid the necessity of univocal terms; but in terms of contemporary analysis, this would not vitiate the theory of analogy, even though it would contradict assumptions of St. Thomas. Such univocal terms would not however obviate the necessity of an analogy-theory for a philosopher who accepts St. Thomas' basic assumptions.
- 8. Bochenski's isomorphic theory of similarity of relations does not avoid the necessity and possibility of univocal terms in language about God and, furthermore, has not been developed completely enough to show that some meaningful and true propositions have been demonstrated.
- 9. Cajetan's interpretation of analogy of attribution is the only one in accord with ordinary language; the Suarezian interpretation would make all proofs for the existence of God circular, and Sylvester of Ferrara's interpretation involves circularity and an unnecessary multiplication of descriptions.

10. All proofs for the existence of God and for the various attributes of God are hypothetical on the unproved assumptions of the theory.

The fact that the thesis results in a claim that the analogy-theory does not do what St. Thomas wanted it to do, is not to be understood as a complete rejection of the theory. If an adequate criterion of similarity of relations can be found, and if the three assumptions (no. 5 above) of St. Thomas can be justified, there will be much to be said for the theory of analogy. Furthermore, modern philosophers concerned with the relation of language to events, and with the transfer of modes of description from egocentric events to physical-object language, can gain valuable inspiration from a careful study of the analogy theory of St. Thomas.

Microfilm \$3.05; Xerox \$10.60. 236 pages.

# THE AFFECTIVE CRITICISM OF I. A. RICHARDS.

(L. C. Card No. Mic 59-3344) Gerald Allen Rudolph, Ph.D.

Gerald Allen Rudolph, Ph.D. University of Washington, 1959

Chairman: Melvin Rader

There has been repeatedly in the last three decades a critical argument which, if correct, would be conclusively damaging to Richards' affective theory of aesthetics. The critics' argument is that Richards cannot, using his own criteria, judge differences between different "objects," that Richards cannot differentiate between particular objects. The thesis here is that no matter how one interprets the phrase "object" in the critics' argument, the

critics are in error because Richards can be interpreted as providing criteria for the differentiation between particular objects. Since the critics have been maintaining essentially that Richards has no criteria for differentiating between different public objects, the critics' "object" is interpreted here as being public, some knowledge of which is derivable through sense perception.

From the critics' argument that Richards' affective theory removes the external object from consideration in aesthetic enquiry, Richards' comments are analyzed to discover whether the critics are correct. It is noted at the beginning of the paper that Richards advocates the expansion of the simple judgment-statement "this is beautiful" into the proposition that "this external object causes an experience in me which is valuable in certain ways." The various interpretations of the different segments of this expansion are discussed and it is concluded that Richards does not forget that there is an external object or event as part of the enquiry and that he also provides a connective between this external object or event and the subsequent response. In the analysis of the condition of "causing an experience" the relevant interpretations of "formal elements" are pointed out and the types of connectives and the manners of connections between the external object and the response are noted. As a result of the analysis of the "imaginatively constructed object," which is the interpretation of the external object, the difficulties in formulating a definition of the construct, "the poem," are pointed out.

Microfilm \$2.00; Xerox \$6.80. 143 pages.

MYSTICISM, MORALITY, AND FREEDOM: THE ROLE OF THE VITAL IMPETUS IN BERGSON'S THEORY OF ETHICS.

(L. C. Card No. Mic 59-3350)

William Francis Unsoeld, Ph.D. University of Washington, 1959

Chairman: Paul Dietrichson

The object of this dissertation is to investigate any relationship which might exist between mysticism and

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morality. In order to narrow the subject to a manageable compass, the work of Bergson was made the sole area of concentration. Since Bergson affirms a strong relationship of dependency between mysticism and morality, a critical analysis of his particular views on the subject could be expected to illuminate the subject in general.

The method of procedure adopted consists first of a thorough exposition of Bergson's position with respect to both mysticism and morality. Here the key concept is clearly that of the elan vital, so particular care is taken to explain its nature, function, and origin in Bergson's thought. Once the concept of the elan vital is clarified, its relationship in Bergson's thought to both mysticism and morality is then demonstrated.

In the course of explaining Bergson's views on morality, the question of freedom arises. In view of the extreme importance of this concept to both Bergson's idea of morality and to his idea of mysticism, a careful clarification of what he means by "freedom" is included.

In addition to the exposition of Bergson's views on mysticism, morality, and freedom, the method adopted in the dissertation includes a critical appraisal of the acceptability of these views. This evaluative material forms the last chapter in each of the two parts of the thesis.

The conclusions which are drawn from the enquiry which is outlined above are these:

- 1. Bergson has proposed a defense of mystical knowledge-claims which is at least within the bounds of empirical possibility. To Bergson's arguments on this score, we have added others which go far to break down those objections to mystical knowledge-claims which are based on their "private and ineffable" character.
- 2. Bergson's views on "obligation" are best understood if he is interpreted as being interested in obligation chiefly as a form of motivational tendency, rather than as a unique moral dimension.
- 3. Bergson's own view of freedom is unable to provide an adequate basis for moral obligation, if it is considered simply on its own merits. However, if it is limited in application to Bergson's realm of mystical morality (a limitation which Bergson himself never envisaged), then it provides a highly important contribution to the theory of ethics in general.

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St. Thomas or possible as an independent theory of

Microfilm \$3.45; Xerox \$11.80. 267 pages.

PHYSICS, GENERAL

FFECT OF EDGE PARAMETERS ON FRESNEL DIFFRACTION OF LIGHT AT A STRAIGHT EDGE.

(L. C. Card No. Mic 59-2982)

J. Dean Barnett, Ph.D. University of Utah, 1959

Chairman: F. S. Harris, Jr.

Precision photometric measurements of the optical Fresnel diffraction pattern produced by a straight edge were made on eight edges of various materials and with various edge cross sections to ascertain the effect of these parameters on the pattern. For unpolarized light at a wavelength of 5461 A, approximately 600 fringes were detected and measured in each pattern, and 800 fringes were detected in some of the patterns. The theoretical position of the geometric shadow  $(I/I_0 = .25)$  is verified to an angular accuracy of 1 x 10-4 degrees. The light intensity distribution was scanned at a constant speed while a 1P21 photomultiplier tube cooled to dry-ice temperature detected the light intensity which was then recorded on a strip-chart recorder. The distance between the light source and the photometer was 52 meters, and the edge was placed 20 meters from the source. A simple technique for automatic compensation for fluctuations of the primary light source is also described. Accuracy of approximately 0.2 per cent in the intensity measurements and of 0.03 per cent in fringe position far from the shadow boundary is claimed. To within the accuracy of the experiment, the intensity distribution for all eight edges agreed throughout the complete pattern, but there is a slight variation in fringe position from the simple scalar theory. Microfilm \$2.00; Xerox \$5.40. 109 pages.

THE ACTIVATION ENERGY FOR SURFACE MIGRATION OF TUNGSTEN ATOMS ON TUNGSTEN.

(L. C. Card No. Mic 59-3401)

Philip Charles Bettler, Ph.D. Oregon State College, 1959

Major Professor: James J. Brady

An activation energy for the surface migration of tungsten atoms on the tungsten crystal lattice structure and under the influence of a high electric field has been measured using field emission techniques. The hemispherical field emitter surface deforms into a polyhedral form when the emitter is heated in the presence of large

electrostatic forces, a process known as build-up. In the present work the build-up was studied at temperatures of 1700°K to 2100°K; the emitter radii were in the range of 2.8 x 10<sup>-5</sup> cm to 4 x 10<sup>-5</sup> cm and corresponding constant voltages between 4 kv and 8.5 kv were used. Build-up proceeds in a regular and reproducible manner; certain stages of build-up can be identified by related changes in both the field emission pattern and the field current-time characteristic. An apparent activation energy of 56.3 + 1.2 Kcal/mole was determined for the transport process involved in build-up by use of the measured values of time required for build-up at various temperatures. This may be compared with the value of 73.0 Kcal/mole determined for the surface migration of tungsten-on-tungsten for the blunting of an emitter tip in the absence of an electric field. Explanations for the difference are presented.

Two factors are involved: (1) a reduction in activation energy through the effect of polarization of the surface atoms by the electrostatic field and (2) an inherent lower value ascribed to the difference in the paths of migration in the two cases whereby for the conditions existing in this experiment the activation energy measured is that corresponding to migration primarily over the low index (100), (110) and (211) planes.

A correction term for the field effect has been determined experimentally, giving a corrected value of Q = 66.5 + 1.3 Kcal/mole for the activation energy for the surface migration over the above mentioned planes.

Microfilm \$2.00; Xerox \$5.80. 118 pages.

POSITRON ANNIHILATION IN CU, BI, S AND C.

(L. C. Card No. Mic 59-2478) Felix Castillo-Jimenéz, Ph.D. The University of Texas, 1959

Supervisor: Dr. W. E. Millett

It has been observed that a positive electron or positron interacts with matter by annihilating itself and an electron to produce gamma radiations. Theory predicts and experiments verify that such annihilations can produce one, two, or three photons. The conservation of momentum and energy in the annihilation process determines the energy and directions of such radiation. For the case of two gamma annihilation, the paths of the two gammas will be anti-parallel in the center of mass coordinate system. Any deviation from this in the laboratory system is caused by the motion of the positron electron system with respect to the laboratory which, if the positron is thermalized, must be attributed primarily to the electron. Thus this phenomenon can be used as a tool for studying the momentum distribution of the electrons that participate in the annihilation.

In this experiment the angular correlation of two photon annihilation was studied for several samples utilizing an apparatus with cylindrical geometry. The equipment was constructed as a part of the project and is described in detail. The angular resolution of the apparatus is approximately 2.3 MR.

The samples studied were copper; bismuth; sulfur, both monoclinic and rhombic; and carbon in the diamond and graphite states. The graphite sample consisted of oriented crystalites. Anisotropy effects were studied by measuring the angular correlation of the radiation with the "c" axis perpendicular to and parallel with the axis of the equipment. The data was corrected for instrument resolution and analyzed to give N(p), the momentum distribution of the positron-electron pair, and  $\rho(p)$ , the momentum density, as a function of momentum.

The momentum distribution for the two metallic conductors varies considerably. For Bi, N(p) is essentially a Fermi distribution for a free electron gas, indicating that the positron is thermalized prior to annihilation and that the annihilation cross-section is approximately independent of the electronic velocity. For Cu, N(p) has a complex structure. There is a component of the N(p) curve that appears to correspond to the Fermi distribution, but a second component, at higher momentum is also present. This high momentum component could be caused either by some of the positrons annihilating with "core" electrons, or from the fact that the positron is in a periodic potential and has appreciable zero-point energy. This latter effect is referred to by Lang and De Benedetti as the "excluded volume effect."

The two carbon samples gave widely differing N(p) curves; graphite appears much like the Fermi distribution of a metal, whereas diamond has a very strong high momentum component. An effort was made to explain these results also by the "excluded volume effect."

The two sulfur samples gave quite similar N(p) curves indicating perhaps that the structure of the crystalites in the rhombic and monoclinic states is quite similar.

Microfilm \$2.00; Xerox \$4.40. 83 pages.

### MASS SHIFT OF DECAYING PARTICLES.

(L. C. Card No. Mic 59-3438)

Richard Loren Jacob, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor R. G. Sachs

Starting from the basic assumption that the interactions of an elementary particle with other particles contribute to its mass, or self-energy, the problem of the mass shift of unstable particles due to the interaction responsible for the decay is discussed. In particular, the mass difference of the two neutral K-mesons, the  $\theta_1$  and the  $\theta_2$ , is considered.

The interactions are assumed to be invariant under CP. Therefore the  $\theta_1$ , being even under CP, can interact with two pions, which are also even under CP, while the  $\theta_2$ , being odd under CP, cannot. On the other hand, the  $\theta_2$  can interact with a single neutral pion, which is odd under CP, while the  $\theta_1$  cannot. These differences in the

interactions of the  $\theta_1$  and the  $\theta_2$  will contribute to their mass difference. Since the  $\theta_1$  and  $\theta_2$  have different character under CP, they will also interact differently with nucleons and hyperons, which will also contribute to the  $\theta_1 - \theta_2$  mass difference.

The problem of the mass shift of unstable particles is approached from three different view points, non-relativistic perturbation theory, relativistic perturbation theory, and the LSZ formulation of field theory. It is shown that in each of the three methods the energy shift can be written as a sum of matrix elements over all intermediate states that conserve momentum but not energy. In field theory this sum is just the real part of the diagonal element of the *m*-matrix.

In applying these results to the problem of the  $\theta_1$  -  $\theta_2$  mass difference, the contributions from the one pion, two pion, and nucleon-antinucleon pair states are considered. The contributions from the one pion and the nucleon pair states are quite uncertain because of the lack of knowledge of the matrix elements. In the perturbation calculations, using simple models for the interactions, these contributions diverge at least quadratically and hence are very sensitive to the value chosen for the momentum cut-off.

For the two pion contribution, the experimental information on the two pion decay of the  $\theta_1$  gives the value of the matrix element for the case in which energy is conserved, thus making it possible to express the mass difference in terms of the lifetime. The perturbation calculation diverges only logarithmically, giving for the order of magnitude of the two pion contribution to the  $\theta_1$  -  $\theta_2$  mass difference

$$\Delta \mu \sim \frac{1}{\tau} \simeq 6 \times 10^{-6} \text{ ev.}$$
  
Microfilm \$2.00; Xerox \$5.60. 112 pages.

HYPERFINE STRUCTURE OF THE 6<sup>3</sup>P<sub>2</sub> STATE OF <sub>80</sub>Hg<sup>199</sup> AND <sub>80</sub>Hg<sup>201</sup>: PROPERTIES OF THE METASTABLE STATES OF MERCURY.

(L. C. Card No. Mic 59-3117)

Mark Nordman McDermott, Ph.D. Columbia University, 1959

The hyperfine structures of the metastable 6<sup>3</sup> P<sub>2</sub> state of Hg<sup>199</sup> and of Hg<sup>201</sup> have been measured by means of an atomic beams technique. An electron bombardment method was used for producing the beam of metastable atoms which was detected by surface ejection of electrons from an alkali metal surface. The zero field intervals f(F, F') are: for Hg<sup>199</sup>

f(5/2, 3/2) = 22,666.559(5) Mc; and for Hg<sup>201</sup>,

f(7/2, 5/2) = 11,382.6288(8) Mc,

f(5/2, 3/2) = 8,629.5218(5) Mc

f(3/2, 1/2) = 5,377.4918(20) Mc.

The  $g_J$  values for the  ${}^3P_2$  state and the  $(5d^96s^26p)$   ${}^3D_3$  state were found to be  $g_J({}^3P_2) = 1.50099(10)$  and  $g_J({}^3D_3) = 1.0867(5)$ .

Microfilm \$2.00; Xerox \$3.00. 51 pages.

# THE HYDRODYNAMICAL PERFORMANCE OF MIGRATING SALMON.

(L. C. Card No. Mic 59-3018)

Matthew Fontaine Maury Osborne, Ph.D. University of Maryland, 1959

Supervisor: Elliot W. Montrall

The annual migration of pacific coast salmon up the Amur and Columbia rivers to spawn, has been analyzed as a gigantic water tunnel experiment, in which the fish, a vehicle with a fixed initial fuel load and no refueling en route, ascends a known current on a known schedule, with a known payload of reproductive products. The following performance specifications, which may be regarded as optimum ones for marine vehicles, are assigned to the fish: 1) An overall efficiency of 24% for converting the heat of combustion of the fuel (primarily fat) to directed kinetic energy in the wake. 2) A drag coefficient corresponding to a turbulent boundary layer with no separation. 3) A choice for the speed of swimming against the river current corresponding to the least fuel consumption. The fish is assumed to swim against the average current without seeking systematically either low or high velocity water. Under this assumption the embarrassing conclusion is reached that, with the exception of dog salmon up the Amur, and fall chinook up the Columbia, the average fish does not have sufficient fuel to reach his destination. The margin of failure is rather small, except in the case of blueback salmon. The most likely explanation of the discrepancy is the failure of the assumption that the fish swims against the average current, since there appears to be good evidence that, except in special circumstances, the fish do systematically seek out low velocity water in the course of their ascent. Even so, the maintenance of such top performance specifications under varied conditions must be regarded as quite astonishing. Alternative explanations are briefly considered.

An analysis of salmon counts over the Bonneville and Rock Island dams was carried out, to determine the effect of the varying discharge of the Columbia River on the delay in days between these two dams. The general effect of this discharge, as it varies throughout the year, is to slow the fish down and scatter them about. However, at a fixed season of the year, the effect of a discharge varying from one year to the next is to speed the fish up prior to the flood peak in June, and conversely thereafter.

Data is also given enabling a calculation of the average velocity of the Columbia River as a function of discharge, from the mouth to its source.

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Microfilm \$2.00; Xerox \$4.40. 85 pages.

### ELEMENTARY DOMAINS IN SMALL-ANGLE X-RAY SCATTERING FROM COLD-WORKED METALS.

(L. C. Card No. Mic 59-3439)

Fremont Reizman, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor W. W. Beeman

Two lines of investigation are followed in this thesis: annealing kinetics of cold-rolled metals and the thicknessdependence of the scattering.

#### A. The thickness-dependence

The scattering from a cold-rolled foil is determined as a function of foil thickness, with a view to distinguishing between scattering which takes place at point-scatters and the two-domain double scattering mechanism. A geometrical theory of the thickness-dependence for the double scattering process is derived, and it is shown that the scattering fits the predictions of this theory rather than that for a foil containing point-scatters. It is concluded from these measurements that the scattering comes from the two-domain double Bragg reflection process, and that the scattering domains are the subgrains within a polygonized grain.

#### B. Annealing Kinetics

The annealing rate of the small-angle x-ray scattering is investigated as a function of the temperature, by annealing foils in the x-ray beam. It is found that, at a constant temperature, Nickel foils anneal with kinetics characteristic of recrystallization, while Copper foils anneal with kinetics suggesting subgrain growth. Activation energies are derived and found to be in rough agreement with those obtained by other workers using other methods.

It is concluded in these measurements that the scattering, which arises from the double Bragg reflection mechanism within polygonized grains, is being reduced on annealing as the subgrain structure is obliterated by subgrain growth (Copper) or recrystallization (Nickel).

Microfilm \$2.00; Xerox \$3.80. 70 pages.

COHESIVE ENERGIES OF SOME RARE EARTH METALS.

(L. C. Card No. Mic 59-3392)

Olof Conrad Trulson, Ph.D. Iowa State College, 1959

Supervisor: Donald E. Hudson

The cohesive energies of the rare earth metals europium, gadolinium, holmium, and erbium have been determined from their measured latent heats of sublimation taken at elevated temperatures. Heats of sublimation were obtained with the Clausius-Clapeyron equation from measured relative vapor pressures of the metal samples

as a function of temperature. Several sublimation runs were made with each sample and a weighted average latent heat for each element was obtained. A least squares analysis of the experimental data was employed to determine the mean latent heat for each run.

Relative vapor pressures were determined from the rate of effusion of the rare earth vapor from a conventional Knudsen-type cell. A fraction of the effusing atom flux was ionized by a heated tungsten filament and the ion beam was directed into a 60° sector mass spectrometer. The collected ion current thus gave a measure of the vapor pressure inside the cell.

The following latent heats of sublimation were obtained: Eu, 42.04 ± 0.41 kcal/M at 727°K from 14 runs; Gd, 78.20 ± 0.33 kcal/M at 1370°K from 9 runs; Ho, 72.80 ± 0.44 kcal/M at 1248°K from 21 runs; and Er, 73.01 ± 0.35 kcal/M at 1207°K from 14 runs. The corresponding cohesive energies (i.e., heats of sublimation at 0°K) were: Eu, 43.43 kcal/M; Gd, 81.96 kcal/M; Ho, 75.38 kcal/M; and Er, 75.54 kcal/M. The lower cohesive energy of europium was attributed to the divalent tendency of this metal such that only two electrons per atom are available for binding, whereas there are three binding electrons per atom in each of the other metals.

Order of magnitude estimates of the vapor pressures (in mm Hg) of these metals were obtained from the results of the present measurements and the results of other measurements at this Laboratory. They were: Eu, 4 x  $10^{-5}$  (727°K); Gd, 1 x  $10^{-5}$  (1370°K); Ho, 4 x  $10^{-6}$  (1248°K); and Er, 1 x  $10^{-6}$  (1207°K).

Microfilm \$2.30; Xerox \$8.00. 175 pages.

# SPECIFIC HEAT OF THORIUM AT HIGH TEMPERATURES.

(L. C. Card No. Mic 59-3396)

Duane Conrad Wallace, Ph.D. Iowa State College, 1959

Supervisor: Gordon C. Danielson

The specific heat and electrical resistivity of high purity thorium have been measured from room temperature to  $1000^{\circ}$ C. The specific heat was measured by an electrical pulse heating method. The results have been analyzed in terms of additive lattice and electronic specific heats, and a qualitative band structure for  $\alpha$ -thorium has been proposed. The Hall coefficient, the resistance at high temperature, the Seebeck coefficient, and the paramagnetic susceptibility of thorium have been discussed according to the proposed model. Some remarks have been made concerning the extension of the thorium band structure to protactinium and uranium.

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Microfilm \$2.00; Xerox \$5.60. 114 pages.

A STUDY OF THE LATE AFTERGLOW IN ACTIVE NITROGEN WITH MODERN TECHNIQUES.

(L. C. Card No. Mic 59-3353)

Robert Allen Young, Ph.D. University of Washington, 1959

Chairman: Dr. Kenneth C. Clark

The nitrogen afterglow has been investigated in a static system using high speed spectrographs equipped, at times, with a servo controlled moving aperture which enables time resolved spectrograms to be obtained. More accurate time studies have been made with several photomultipliers used simultaneously to monitor different wavelength intervals in conjunction with a high sensitivity, fast response Wrede gauge.

In the spectroscopic study, the following important new results have been established: 1) No change in the relative intensity of the first positive system within the visible portion of the spectrum occurs during two minutes of decay; 2) The intensity maxima at v' = 11, 6, and 2 persist for at least 30 seconds during the decay; 3) The 5577A green auroral oxygen line has been found to persist for 30 seconds in the decay; 4) The intensity of the 5577A OI line changes with time as the NO $\beta$  bands; 5) Both the NO $\beta$  bands and the oxygen green line decay more slowly with time than the first positive bands of nitrogen.

We have drawn the following conclusions from these observations: 1) Metastable particles, formed in the discharge preceding the afterglow, play no significant part in the production of the afterglow; 2) The presently accepted mechanism of collision transfer from the  $^5\Sigma$  to  $B^3\pi$  radiative state of nitrogen for the production of the afterglow is incorrect or incomplete; 3) The OI green line is produced by the mechanism

$$NO(X^2\pi)^{n=5} + N(^4S_0) \rightarrow N_2(X'\Sigma) + O('S_0)$$

4) The vibrationally excited NO molecule does not relax through five vibrational states in  $10^6$  collisions; 5) Wigner's spin conservation rule inhibits the reaction in (3) by a factor of 2 x  $10^{-4}$  compared to the identical reaction producing ground state atomic oxygen atoms for which no spin change is required; 6) The atomic oxygen present in the afterglow decays more slowly than the atomic nitrogen during the early decay.

The photomultiplier investigations have established the following important results: 1) During the exponential decay in the afterglow, both a volume and a wall loss occur; 2) The catalytic efficiency of the observation bulb walls varies inversely as the pressure; 3) The catalytic efficiency of the following surfaces are, Glass 1.12 X 10<sup>-5</sup>.

Teflon  $\frac{3.16 \times 10^{-6}}{p}$ ; Icosane  $\frac{2.0 \times 10^{-6}}{p}$ ;  $P_2 O_5 \cdot H_2 O_5$ 

 $\frac{2.3 \times 10^{-7}}{p}$ ; 4) The catalytic action is due to an absorbed layer of gas held weakly by surface forces whose strength increases in the following order: icosane, Teflon, glass,  $P_2O_5 \cdot H_2O$ ; 5) The diffusion coefficient of atomic nitrogen is  $\frac{2.22}{p} \times 10^2$  cm<sup>2</sup>/sec which implies a collision diameter of 2.7A; 6) The effective recombination coefficient producing the following radiations differ in their pressure

dependence: (a) first positive bands of  $N_2$ , (b) the CN red and violet bands, (c) unknown green (5550-5650A) bands; 7) The recombination coefficients mentioned in (6) are not directly proportional to pressure.

We have drawn the following conclusions from these facts: 1) At least three different excitation mechanisms are operative in the afterglow; 2) These processes are more complicated than those currently accepted; 3) The first positive bands may be emitted through the formation of a collision complex involving N, O; 4) The proposed mechanism will explain the observed behavior of the first positive bands.

Through the use of photomultipliers in conjunction with the Wrede gauge, we have established the following facts:

1) The pseudo-recombination coefficient of both the atoms and the first positive bands have the same pressure dependence;

2) Both recombination coefficients increase as the pressure decreases;

3) The term in the exponential decay constant of the Wrede gauge proportional to pressure is twice the similar term in the decay constant of I<sup>1/2</sup> for the first positive bands, while the remaining terms are equal.

We conclude from these observations that the intensities of the first positive bands are not proportional to the square of the atom concentration but are proportional to the product of the concentrations of two species, one of which the gauge detects. Our proposed mechanism is consistent with these requirements if equilibrium between the collision complex and the atoms is not maintained at these low reactant concentrations.

Microfilm \$2.00; Xerox \$5.80. 117 pages.

# PHYSICS, ELECTRONICS AND ELECTRICITY

THEORETICAL CONSIDERATIONS IN THE DESIGN OF AN ELECTRON GUN AND THE EVALUATION OF MEASURED EXCITATION FUNCTIONS.

(L. C. Card No. Mic 59-2990)

Raimo Bakis, Ph.D. Kansas State University, 1959

A method of designing electrode structures which reduce the space-charge induced potential variation in a ribbon-shaped electron beam is described. The electrostatic potential in the beam and its vicinity is expressed as a cosine series:

$$\begin{split} &U_{N}(x,y) = \frac{-\rho_{0}}{4\epsilon_{0}} \left\{ \left| y \right| + \frac{\alpha}{\pi^{2}} \sum_{n=1}^{N} \left(-1\right)^{\frac{n-1}{2}} \left[ 1 + \left(-1\right)^{n-1} \right] \frac{1}{n^{2}} \\ &\left[ \exp\left(\frac{n\pi \left| y \right|}{\alpha}\right) - \exp\left(\frac{-n\pi \left| y \right|}{\alpha}\right) \right] \cos\frac{n\pi x}{\alpha} + \frac{2\alpha}{\pi^{2}} \sum_{n=N+1}^{\infty} \left(-1\right)^{\frac{n-1}{2}} \\ &\left[ 1 + \left(-1\right)^{n-1} \right] \frac{1}{n^{2}} \left[ -\exp\left(\frac{-n\pi \left| y \right|}{\alpha}\right) \right] \cos\frac{n\pi x}{\alpha} \right\} \end{split}$$

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Here the beam is supposed to occupy the region y=0,  $|x|<\frac{\alpha}{2}$  and the space-charge density and potential are assumed to be independent of x. It is shown that as N increases without limit, the potential  $U_N$  converges to zero uniformly in the region of the beam. In an infinitely thin ribbon, therefore, the potential variation can be made arbitrarily small by surrounding the beam with electrodes which produce the potential described by the above equation with some sufficiently large N.

The values of  $U_N$  for N=1 were calculated and the equipotential lines for this potential distribution are presented graphically. It is found that the potential variation in this beam is approximately 3.6 times smaller than in a beam of circular cross section and uniform charge density.

The design and construction of an electron gun utilizing a ribbon-shaped beam are described. The electrodes in this gun were designed to produce a potential distribution corresponding approximately to that given by the above equation with N=1.

A mathematical procedure for correcting the errors introduced into excitation function measurements by the lack of uniformity of electron energies is described. The procedure consists essentially of calculating a Fourier transform of the measured excitation function, dividing it by the transform of the electron energy distribution function of the beam, and applying the inverse transformation to the result. The effect of random errors in the measured values of the excitation function is considered, and it is shown that under certain conditions the errors in the measured values may produce much larger errors in the corrected function. To reduce these errors, it is necessary to multiply the above-described quotient of transforms by a suitable function before applying the inverse transformation. This function must vanish or nearly vanish for those values of the argument for which the transform of the energy-distribution function is very small. By this means the random errors in the corrected function can be reduced, but other types of distortion are introduced.

Experimental results of measurements of excitation functions of selected lines of the mercury spectrum are presented. These measurements were made with the electron gun described above. The intensities of the spectrum lines were measured with a refrigerated photomultiplier by counting the output pulses of the multiplier for periods of one minute. The results were corrected for the energy spread of the electrons as described above. The magnitudes of random errors in the measured functions were estimated from the values of the Fourier transforms of these functions at those values of the argument at which the transform could be expected to have negligibly small values in the absence of random errors.

The results showed the excitation function for the 3665 A line to have three closely spaced maxima which had not been clearly resolved by previous investigators. The 5461 A line also showed several maxima. The excitation function for this line has been recently studied by other investigators who have also found multiple maxima. The present results agreed satisfactorily with theirs.

Microfilm \$2.00; Xerox \$4.40. 83 pages.

THE DIFFUSION OF RESONANCE EXCITATION THROUGH A GAS.

(L. C. Card No. Mic 59-3363)

Robert Gerald McIntyre, Ph.D. The University of Oklahoma, 1959

Chairman: Professor R. G. Fowler

"Resonance radiation" is the term applied to radiation emitted by an atom in a transition from an excited state to the ground state. Since it is much more absorbable than other components of atomic spectra, the mechanism by which it propagates to the walls of a vessel are considerably more complex. The phenomenon of diffusion of resonance excitation through a gas was first studied by K. T. Compton, who gave a theoretical treatment which regarded the transfer of excitation as a type of Brownian motion. His result was a diffusion-type equation for the density of excited atoms. R. G. Fowler has pointed out that Compton and all subsequent authors have ignored the excitation transfer which is a result of the movement of atoms in an excited state.

In returning to purely kinetic-theoretical methods of describing the phenomenon of diffusion of resonance excitation through a gas, a linear differentio-integral equation has been derived. The differential terms are the same as those appearing in the Boltzmann Equation, with no external field. However, the exchange integral is dropped. Instead, there appears a new integral term representing the transfer of excitation during an emission-absorption process during which an excited atom loses its excitation energy to an atom in the ground state. At all times each quantum of excitation energy is considered to have a unique position of some atom in the vessel.

The boundary conditions for which a solution to the differentio-integral equation is sought are those of a slab of gas, excited uniformly in space and Maxwellian in velocity, and bounded only by two parallel planes at a finite distance apart. An assumption is made that, for a short time after initial excitation, the solution may be closely approximated by a product of the solution for the uniform steady state times a continuous function of position, velocity and time having all derivatives, hence, a Taylor's Series expansion. Terms of greater than the second order were dropped.

The approximate solution obtained is of interest for a number of reasons. It demonstrates clearly the importance of the diffusion term in the Boltzmann Equation.

Moreover, it indicates the most important measurement in an experimental study of the phenomenon to the timevarying distribution of the escaping radiation versus its frequency. Certain initial conditions are suggested which would lead to a more reliable test of the theory than would those for which the present solution was obtained.

Microfilm \$2.00; Xerox \$4.20. 79 pages.

PHYSICS, METEOROLOGY

CONDITIONS AFFECTING THE WIND-STRESS AND EVAPORATION AT NATURAL WATER SURFACES.

(L. C. Card No. Mic 59-3319)

James Warner Deardorff, Ph.D. University of Washington, 1959

Available methods of evaluating the wind-stress and

Chairman: Dr. Robert G. Fleagle

evaporation rate for natural water surfaces are reviewed. The validity of the aerodynamic method of determining evaporation from water surfaces is supported by a reexamination of the Lake Hefner studies, in which the quantity  $\sqrt{\frac{K_z}{K_m}}$  & is found to lie between .35 and .41 under adiabatic conditions.  $K_z$  and  $K_m$  are the eddy diffusivities for water vapor and momentum, respectively, and & is the Karman constant which is usually considered to have a value of about .40.

Values of the resistance coefficient (the ratio of the wind-stress to the product of air density and square of the wind speed), the evaporation coefficient (the ratio of the logarithmic height derivative of the water vapor density to the departure of the vapor density from the equilibrium value for the water surface), and the evaporation factor (the ratio of the evaporation rate to the product of wind speed and deficit of the air vapor density from its equilibrium value) obtained for various natural water surfaces by a variety of methods are reviewed and the sources of experimental error discussed. It is concluded that such errors cannot account for most of the large measured variations of the coefficients.

No definite relationship between the resistance or evaporation coefficients and the fetch is apparent at low wind speeds. The increase of evaporation coefficient with increasing wind speed which has been found for very large fetches requires further confirmation and explanation.

The value of the resistance coefficient appears to be strongly dependent on traces of natural surface contamination through damping of the capillary waves. Upon comparison of the expected degree of surface contamination with the measured resistance coefficients it seems likely that the large values obtained by some investigators, particularly at low wind speeds, were associated with relatively clean water surfaces, and that measured values characteristic of a hydrodynamically smooth surface were associated with the presence of a nearly continuous but invisible surface film. Diatom plankton are believed to be chiefly responsible for the presence of natural oils on most water surfaces.

The evaporation coefficient is less sensitive to traces of contamination, and is apparently reduced appreciably only by compressed or thick surface films often visible as slicks.

A comparison of the evaporation factor obtained by the writer for a pond with area of about one square meter with that found for a bay with about a 10 km fetch indicates that this factor does not necessarily increase with fetch within this range of fetches. Measurements by others of the evaporation factor (which depends upon the product of the resistance and evaporation coefficients) have resulted in

larger values for the oceans than have been obtained in coastal regions. This result agrees with the expectation that the evaporation factor will be largest for bodies of deep water away from shorelines, where least surface contamination is generally thought to exist.

Microfilm \$2.00; Xerox \$6.80. 142 pages.

#### PHYSICS, NUCLEAR

DISPERSIVE EFFECTS IN ELECTRON-NUCLEUS PROBLEMS.

(L. C. Card No. Mic 59-2952)

Nicholas Anthony Krall, Ph.D. Cornell University, 1959

The purpose of this dissertation is to evaluate quantitatively the effects of some of the non-static aspects of nuclear matter on the elastic interactions it has with electrons; in particular, the effect on scattering cross-sections in the 200 Mev-500 Mev range, where electrons are scattered from deuterium, helium, carbon, calcium, and bismuth, and secondly, the effect of these non-static aspects in shifting the energy of low lying bound electrons in atoms. The usual treatment of the electron-nucleus problem pictures the nucleus as a static charge distribution. In reality, individual nucleons may make transitions to and from excited states during the Coulomb interaction with electrons, and it is the effect of these virtual transitions that will be discussed here. These effects are often termed dispersive effects.

The scattering problem is formulated in Born approximation, and the second Born approximation, where these non-static aspects first occur, is solved with reasonably high accuracy (to within 10%). This second Born approximation contains, besides the terms referring to the non-static nature of the nucleus, a term which is present equally in a charge cloud picture or a real nucleon picture as used here. This "static charge" contribution is calculated explicitly, and by subtractions the part due only to dispersive effects is obtained. In several parts of the calculations, especially for targets other than the deuteron, a high speed electronic computer is used to do some rather complicated integrations.

The bound state problem is approached through perturbation theory, and dispersive effects occur in second order. The problem is developed so as to demonstrate the resemblence to the scattering problem, even though the starting points are quite different. Here the dispersive effects are evaluated separately from the second order static effects, which are shown to be much smaller than the dispersion. The calculation evaluates the shift of the  ${}^2S_{1/2}$  electron level in deuterium and helium due to nuclear structure, and gives a less accurate indication of this effect for all elements below Z = 50.

The results from the scattering calculation compile cross sections (static first order, static second order, dispersive) for the elements named, at a variety of energies and angles. For the deuteron, they may be summarized by a completely empirical formula, in terms of

the form factor, the point charge cross section, the momentum change q and the scattering angle  $\theta$ ,

$$\frac{d\sigma}{d\Omega} = \frac{d\sigma}{d\Omega} \left| \begin{array}{c} F^2(q) & [1 - 0.014 \ q^2 (1 - \sin 1/2 \ \theta)] \end{array} \right|$$
Point

q must be expressed in (fermis)<sup>-1</sup>. This formula is accurate to 8% of the second Born result, especially at high q and large angle.

For deuterium, helium and carbon targets, the results may be summarized by the change in the nuclear size  $R_o$ , as calculated from experiment, when the present results are included:

	$\Delta R_o$	Ro
$D_2$	-0.01x10 <sup>-13</sup> cm	2.11x10 <sup>-13</sup> cm
He <sup>4</sup>	08	1.53 "
C12	05	2.32

For heavier elements, the inclusion of dispersive effects in scattering calculations gives a term proportional to Z, as compared with a term proportional to Z<sup>2</sup> arising from static effects calculated to the same order as dispersive effects. The pertinent conclusion is that any calculation which accurately evaluates the scattering from a static charge picture of heavy nuclei will be wrong by only a fraction of a percent due to dispersion.

The important results for the bound state problem are the shift in the  $^2S_{1/2}$  level of deuterium and helium.

Deuterium: 
$$\triangle E_{2}$$
, Dispersive = 0.013 Mc  
 $\triangle E = \triangle E_{1} + \triangle E_{2}$ , Dispersive = 0.88 Mc

 $\Delta E_{2,Dispersive} = 0.60$  Mc

The number  $\Delta E$  given for deuterium includes the first order contribution, which was affected by the change in

nuclear size calculated here.

Helium:

Microfilm \$2.00; Xerox \$4.20. 79 pages.

#### PHYSICS, SOLID STATE

THERMO- AND GALVANOMAGNETIC
POTENTIALS IN A SINGLE CRYSTAL OF ZINC
AT LIQUID HELIUM TEMPERATURES.

(L. C. Card No. Mic 59-3069)

Clyde Joseph Bergeron, Jr., Ph.D. Louisiana State University, 1959

Supervisor: Professor Claude G. Grenier

Thermomagnetic and galvanomagnetic potentials have been measured in a single crystal of zinc in the liquid helium temperature range. All experiments were performed with a constant electrical or heat current; the magnetic field was varied at a constant rate from 1 to 11 K.G.

The transverse and longitudinal (parallel to the current)

components of the  $\hat{\rho}$  tensor were the galvanomagnetic quantities studied. These are associated with the Hall effect and magnetoresistance respectively. In the thermal case, the measured effects were the thermoelectric voltage and the transverse Ettinghausen-Nernst potential for a constant heat current.

Oscillations as a function of magnetic field strength were observed in all of these potentials. The measured period for the transverse oscillations as a function of 1/H was 6.2 x 10<sup>-5</sup> gauss<sup>-1</sup> ± 0.5%. Both transverse effects possessed strong second harmonic oscillations. The oscillations in the longitudinal effects both exhibited a phase inversion in the neighborhood of 4.2 K.G., the same field region for which the gross Hall field changed sign from a plus to a minus value. In this same field region the period of the oscillations for the longitudinal effects was half that of its low and high field values, i.e. the period of the second harmonic.

The temperature dependence of the amplitude of the oscillations of all four effects was not very strong in the liquid helium temperature range.

If we modify Zil'berman's theory by inserting Grimsal's and Levinger's expression for an oscillatory number of effective carriers into Zil'berman's solution of the electrical conductivity tensor, we can offer some empirical correlations between the reversal of sign of the Hall effect and: 1) the phase reversal of the magneto-resistance oscillations, 2) the strong second harmonic content of these oscillations in the region of the phase reversal, and 3) the quadratic shape of the envelope to the magnetoresistance oscillations in this region.

Zil'berman's theory implicitly assumes the Weidemann-Franz law. However, Azbel et. al. has shown that for the strong magnetic fields and low temperatures for which Zil'berman's theory applies, the Weidemann-Franz law is indeed valid. If we assume that the difference of the absolute thermoelectric power and the temperature derivative of the chemical potential is negligible, we arrive at an empirical explanation of the phase reversal of the oscillations in the longitudinal thermal potential and the presence of the large second harmonic in the neighborhood of the phase reversal.

As a corollary to our attempts to orient the magnetic field along the hexagonal axis, data were collected which possibly contain a component of an effect parallel to the field. Further experimentation might isolate this effect. Also, it would be interesting to repeat the experiments performed for this paper in the liquid hydrogen temperature range. There it might be possible to make a fruitful study of the temperature dependence of the amplitude of the oscillations. Microfilm \$2.00; Xerox \$4.80. 91 pages.

ORDERING AND DISORDERING PROCESSES IN CU<sub>3</sub> AU. II.

(L. C. Card No. Mic 59-3105)

William Gross, Ph.D. Columbia University, 1959

Data are reported which describe both the equilibrium and kinetic change of length with order in a single crystal of Cu, Au. Equilibrium values of the order dependent

change in length per unit length with temperature are given for the region 218° C to 500° C by combining these data with the lattice parameter values of Feder, Mooney and Nowick. The isothermal variation of length with time following a sudden change in temperature is studied for changes below the critical temperature when the specimen is initially in various states of long-range order as well as for quenches through the critical temperature where there is no initial long-range order. The experimental data are compared with the description of the phenomena offered by various equilibrium and kinetic theories. A critical review of these theories is included and an attempt is made to evaluate the effects of the several approximations introduced therein. The question of the relation between lattice constant and long- or short-range order remains unresolved.

Microfilm \$2.00; Xerox \$4.40. 82 pages.

X-RAY EXPANSION AND COLORATION OF PURE AND IMPURITY-DOPED NACL CRYSTALS.

(L. C. Card No. Mic 59-3022)

Herbert Rabin, Ph.D.

University of Maryland, 1959

Supervisor: Dr. Jules R. de Launay

Expansion and coloration measurements of impuritydoped and undoped single crystals of NaCl have been made under x-irradiation (43 kvp at 20 ma) for intervals up to three hours. These measurements were made in a thermostated enclosure at approximately 34°C at a distance of 4-7/8 in. from the tungsten anode of the x-ray tube. Expansion was measured in the direction normal to the x-ray beam with a sensitive capacitive dilatometer designed to compensate automatically for thermal fluctuations; optical absorption measurements were made with a Cary spectrophotometer. The undoped specimens included crystals from the Harshaw Chemical Company, the Optovac Company, a natural crystal from near Baden, Germany, and a Naval Research Laboratory crystal grown by the Kyropoulos technique. The doped specimens also Kyropoulos-grown at NRL included crystals to which potassium, calcium or cadmium chloride was added in amounts up to 1.0 mole percent in the melt.

The rate of expansion was found to be largest at the onset of the x-ray exposure, followed by a relative decrease with the suggestion of an eventual saturation of expansion. Furthermore, the front face of the irradiated crystal was observed to expand more than the back face in accord with its greater x-ray absorption. It was found, contrary to the earlier results of Lin, that the commencement and termination of expansion occurred simultaneously with the commencement and termination of irradiation. In general, it was concluded that the presence of impurity atoms did not sizeably alter the x-ray induced expansion, with the exception of a heavily doped cadmium crystal that had been heated and quenched prior to irradiation to remove an initial turbidity. This crystal showed an expansion that was substantially larger than that shown by any of the other crystals in this study, while an initially transparent crystal with less cadmium and no heat

treatment showed smaller expansion, comparable with the expansion of its undoped counterpart grown at NRL. The expansion of the potassium-doped crystal was quite comparable to the expansion of the Optovac crystal and also the undoped NRL crystal. The large increase in F-band coloration by the addition of calcium to NaCl was not accompanied by a corresponding increase in expansion. Furthermore, the calcium doped crystal was the only crystal that was observed to contract after the cessation of irradiation. The Harshaw crystal showed next to the smallest expansion followed by the natural crystal, which both expanded and colored the least of the crystals studied.

The expansion and coloration results for the various crystals investigated were compared with a theoretical model which assumed the creation of a positive and negative ion vacancy pair for each F-center observed optically. The crystals were generally observed to follow this theoretical model after an initial period in which the model

was not obeyed. This initial disagreement was characterized by the fact that too many F-centers were created to be accounted for by the creation of vacancies. This was interpreted to have resulted from the production of Fcenters from vacancies originally in the crystal. The second stage, characterized by approximate agreement with the theoretical model, was assumed to have resulted from a matched creation of F-centers and vacancy pairs. Within the framework of this two stage process, it was possible to estimate the negative ion vacancy content of a number of the crystals investigated. The calcium crystal had the highest negative ion vacancy estimate, thus explaining its enhanced color sensitivity to x-rays; the origin of these vacancies, however, was not understood in the light of simple considerations of charge compensation and the mass action law.

Microfilm \$2.00; Xerox \$6.80. 142 pages.

#### PHYSIOLOGY

POLYSACCHARIDE ON INFLAMMATION AND CONNECTIVE TISSUE INDUCED IN THE RAT BY THE SUBCUTANEOUS IMPLANTATION OF COTTON PELLETS.

(L. C. Card No. Mic 59-3200)

Ruben Clifford Kelsey, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Roland K. Meyer

The objective of this study was to determine the influence of cortisone (alcohol) and a bacterial polysaccharide, Piromen, on inflammation and formation of connective tissue induced by cotton pellets implanted subcutaneously in rats.

Cortisone administered on the pellet retarded development of the induced granuloma for a period of six days by suppressing proliferation of endothelial cells, fibroblasts, large round cells and polymorphonuclear leucocytes as shown by histological examination. After the sixth day the cellular elements rapidly increased to normal levels. As cell levels increased, the weight of the granuloma increased, also. Total cholesterol content per milligram dry weight tissue was not influenced by cortisone administration. An evaluation of fibrillogenesis indicated that, except for the presence of some preformed collagen in the capsule, more of the collagen present in the early development of these granulomas must have been in a nonfibrous state than that in the controls.

The local effect of Piromen was studied by applying it on the pellet. Piromen administered in this manner over a wide dosage range stimulated the growth of the induced granuloma. The adrenalectomized rat was more sensitive than the intact rat to the prophlogistic effect of Piromen. This effect of Piromen was not completely associated with its pyrogenic activity as two highly puri-

fied derivatives which were 10 and 40 times as pyrogenic as Piromen did not stimulate granuloma growth as much as Piromen. The more pyrogenic of the derivatives produced the lesser effect.

The increase in granuloma size produced by Piromen was not due to an increase in cellularity per unit area as shown by the differential cell count. There were generally more fibroblasts present in these granulomas than in the controls. Piromen had little influence on the amount of cholesterol present in the granulomas, although pellets treated with higher doses of Piromen tended to induce granulomas having less cholesterol. The rate of fibrillogenesis in the capsule and, to a greater degree, in the center of the granuloma was reduced by Piromen over a 30 day observation period. In these chronic experiments granuloma weights decreased to near control levels by the ninth day and then paralleled the control values to the end of experiment.

Piromen administered by intravenous or intraperitoneal injection did not influence granuloma size. However, intraperitoneal injections of Piromen inhibited the antiinflammatory effect of subcutaneously administered cortisone, but did not inhibit the effect of cortisone administered on the pellet. When Piromen and cortisone were placed in combination on the pellet, the prophlogistic effect of Piromen was dominant, although the degree of response was dose dependent. The influence of combined treatment on the number of cells per unit area was intermediate between that of Piromen and cortisone during the first week. For the remainder of the 30 day observation period, there were fewer cells per unit area than in the control, cortisone, or Piromen treated granulomas. The fibroblasts were generally more numerous in the granulomas induced by the pellets treated with Piromen and cortisone than in the controls, but there were fewer endothelial cells.

Piromen plus cortisone treatment of the pellets definitely inhibited fibrillogenesis in the capsule and

center of the granulomas to a greater degree than in the granulomas induced by pellets treated with either Piromen or cortisone alone.

The two more pyrogenic derivatives of Piromen, likewise inhibited the anti-inflammatory influence of cortisone, but were not as effective as Piromen at comparable doses. The more pyrogenic derivative had the least influence in this regard.

Chemical studies show that the granuloma contains more total cholesterol than the surrounding subcutaneous connective tissue, liver, striated or cardiac muscle.

Microfilm \$2.35; Xerox \$8.20. 178 pages.

EFFECTS OF MALATHION AND PIPERONYL BUTOXIDE COMBINATIONS ON THE RATE OF OXYGEN CONSUMPTION OF HOUSE FLIES, MUSCA DOMESTICA, L.

(L. C. Card No. Mic 59-2998)

Milton Tamotsu Ouye, Ph.D. Kansas State University, 1959

Investigations were conducted on the effect of malathion alone, and in combination with piperonyl butoxide, on the oxygen consumption of malathion-susceptible (KUN) and -resistant (CAL) female house flies, and a correlation between mortality, symptomology and respiration.

Oxygen consumption was measured manometrically at 30°C. Carbon dioxide was removed by 0.4 milliliter of 20 per cent potassium hydroxide solution and a rolled strip of filter paper placed in the center well of the reaction flask. One fly was placed into each flask immediately after treatment and was confined to the sidearm. Measurements commenced within 10 minutes after treatment and repeated every 10 minutes for the first 30 minutes, and at 30 minute intervals thereafter. The flies were weighed individually before treatment.

All treatments were made topically on the mesosternum of each four-day old female fly. Intoxication symptoms were recorded before each manometric reading.

No significant differences in the oxygen consumption were noted between acetone-treated and non-treated flies, between control and malathion-treated flies in which no mortality occurred, and finally, between control and malathion-piperonyl butoxide mixture in which no mortality occurred.

A marked stimulatory effect on the rate of oxygen consumption was noted, in all malathion and malathionpiperonyl butoxide treated individuals that ultimately died.

By varying concentrations of malathion applied to both KUN and CAL female flies, it was noted that, within a given range, the duration of the latent period before the marked increase of oxygen consumption was inversely proportional to the concentration.

The following results were evident when taking into consideration only flies that ultimately died, independent of the time of the oxygen consumption peak. The oxygen consumption of KUN females treated with 1.08 ug/fly of malathion was increased 2.6 times normal. (Normal was approximated at 0.055 cu.mm./min./mg. of fly.) Similar dosage of malathion mixed with piperonyl butoxide (10.8 ug/fly) lowered the degree of respiratory stimulation to

2.1 times normal. Lowering the dose of malathion (0.54 ug/fly) reduced oxygen consumption to 2.1 times normal and comparable dose of malathion mixed with piperonyl butoxide increased oxygen consumption to 2.4 times normal.

On CAL females 10.8 ug/fly of malathion increased respiration 2.4 times normal and half the above dosage reduced the degree of respiration to only 2.2 times normal. In both the CAL and KUN strains treated with malathion, lowering the dosage lowered the degree of stimulation slightly.

The sequence of events manifested in intoxication was hyperactivity, knockdown, paralysis, and ultimately apparent death. Paralysis was always followed by death. A sharp rise in oxygen consumption of treated flies was associated with paralysis. Flies not exhibiting paralysis showed no marked increase in oxygen consumption.

Since oxygen consumption reached a peak at a given time, mortality would be expected to be highest at a comparable time after treatment if a sudden rise in oxygen consumption after treatment was correlated with mortality. Hence, malathion (10.8 and 5.4 ug/fly) was applied topically to CAL females. Twenty-five flies were replicated eight times for the higher dosage and six times for the lower dosage. Mortality was recorded at intervals beginning at two hours after treatment. Moribund flies were considered as dead.

The majority (27 per cent) treated with 10.8 ug/fly of malathion were apparently dead or moribund between the three and four hour post treatment period, corresponding to the peak in oxygen consumption rate (210 minutes) for CAL flies treated with comparable dosage. At the lower dosage the majority of the flies (17.4 per cent) were apparently dead or moribund between three and four hours. Again this corresponds to the peak of oxygen consumption rate for CAL females (210 minutes) treated with comparable dosage.

Microfilm \$2.00; Xerox \$3.00. 41 pages.

# THE DEVELOPMENT OF TEMPERATURE REGULATION IN THE OPOSSUM, DIDELPHIS MARSUPIALIS.

(L. C. Card No. Mic 59-3280)

Jack Hougen Petajan, Ph.D. The University of Wisconsin, 1959

Supervisor: Peter R. Morrison

In this study the ability to regulate the body temperature at various ages is described. The development of physical factors important to regulation as well as the development of physiological responses to cold are then considered. Finally a preliminary neuroanatomical study is described.

At ambient temperatures ranging from 5 to 30° C., equilibrium body temperatures were recorded at ages ranging from 57 to 100 days. The change from poikilothermism, a significant rise of body temperature above the ambient level, occurred earliest at 30° C. ambient and 60 days of age, and latest at 5° C., the lowest ambient temperature, at about 70 days. Under these conditions,

normal body temperature (35° C.) resulted 20 to 30 days later.

Before regulation was attained differentials were maintained at low ambient temperatures that were greater than those under mild stress, thus showing that maximum temperature regulation potential was not achieved until the body temperature had fallen appreciably. The logarithmic phases of development of such physical factors as area: weight relation and fur depth were found to end coincident with the development of "good" regulation (at 5° C. ambient). Heat production values required to balance heat loss at various equilibrium temperature differentials were calculated from the thermal conductances of the dead animals. There was good correspondence between the actual metabolism and calculated maximum heat loss at each age. These maximums showed a marked increase during the attainment of regulation beginning around 65 days.

Preliminary neuroanatomical studies were undertaken. When coronal brain sections of 40 and 80 day animals were compared, no differences were detected in the posterior hypothalamus, but nuclei in the anterior hypothalamus were more differentiated in the older animal. Studies of decorticate animals revealed their response to temperature stress to be normal. Spinal animals seemed to show a facilitation of their regulatory response with lower body temperature.

Microfilm \$2.00; Xerox \$5.20. 102 pages.

IONIC BASIS OF POSTSYNAPTIC POTENTIALS IN THE NEURO-MUSCULAR SYSTEM OF LOBSTER.

(L. C. Card No. Mic 59-3554)

John Phillip Reuben, Ph.D. The University of Florida, 1959

The multiple innervation of decapod crustacean musculature including peripheral inhibition provides a unique system for the investigation of synaptic transmission. It is a relatively simple matter to isolate the single motor and inhibitory axons innervating the muscles of the lobster walking limb and to expose the innervated muscle in order to study the synaptic responses. This has been done by inserting into a single muscle fiber (100 to 300 microns diameter) two glass micro-pipettes drawn from capillary tubes to a tip diameter of about one micron and filled with three molar potassium chloride. The membrane potential recorded between one pipette and a ground electrode in the bathing medium was displaced to any desired level by applying current through the other pipette. Measurement of the applied current and the voltage displacement during rest or activity by neural stimulation determines the conductance of the membrane for both conditions.

Insertion of the recording pipette at any point along the length of the membrane revealed no significant variation in the synaptic potentials evoked when the axons innervating the muscles were stimulated. This observation confirms the concept of multiple innervation of the single muscle fibers, and further evidence has indicated that there can be a more uniform innervation of crustacean muscles than previously noted.

The results of many experiments involving the application of different ionic solutions have shown the following: the sodium salts of the lower chain fatty acids as well as nitrate, bromide and iodide could be substituted for chloride in the normal saline without altering the conductance change during the inhibitory postsynaptic potential. Succinate, however, decreased the conductance of the postsynaptic membrane during inhibitory activation. It has been shown, on the other hand, that the excitatory postsynaptic potential is generated by an increase in the permeability of the excitatory postsynaptic membrane toward sodium.

The conductance at the nonsynaptic membrane is highly dependent upon the concentration of calcium in the medium. Increasing the concentration of calcium decreases the conductance, and low concentrations of calcium increase the membrane conductance. Magnesium is synergistic in action with calcium, but these divalent ions compete for similar binding sites on the membrane surface.

It has been concluded that the inhibitory potential is due to an increase in permeability of the postsynaptic membrane toward anions, and that the corresponding source of the excitatory potential is a sodium permeability increase.

Microfilm \$2.00; Xerox \$5.00. 98 pages.

LEAD SELECTION, CARDIAC AXES AND THE INTERPRETATION OF ELECTROCARDIOGRAMS IN BEEF CATTLE.

(L. C. Card No. Mic 59-3416)

William Campbell Van Arsdel III, Ph.D. Oregon State College, 1959

Major Professor: Hugo Krueger

In accordance with a theory proposed by Lewis, as the electrical potential develops in the heart, minute areas of cardiac muscle become electrically negative to adjacent areas and form microscopical dipoles. At any given instant the innumerable microscopic dipoles are equivalent to a single resultant dipole. The resultant dipole has a magnitude and a direction and is referred to as an axis.

To establish the direction and magnitude of a cardiac axis a set of standard anatomical electrode positions is set up to yield ease of application of electrodes, minimum artefacts in the recording and the choice of six leads whose axes are spaced 30° apart. In each lead will be recorded the potential of the resultant dipole multiplied by the cosine of the angle between the dipole and the lead. The axis is determined geometrically by construction from the cosine components.

The QRS axis or vector for calf F-25 may be expressed as  $-4.0\,\underline{i} + 8.1\,\underline{j} + 2.4\,\underline{k}$ . The vector may also be expressed as having an azimuth angle of  $60^{\circ}$  from the left arm toward the head in the leg lead plane, a  $60^{\circ}$  angle of elevation, and a radius vector length of 9.3 units or 0.93 millivolts. The vector points dorsad, cephalad and to the left. The T vector may be expressed as  $-1.2\,\underline{i} - 2.8\,\underline{j} - 1.5\,\underline{k}$ . The vector may also be expressed as having an azimuth angle of  $144^{\circ}$  from the left arm (rotating from the left arm toward the head and then toward the right arm) in the L plane, an angle of depression of  $54^{\circ}$  below the L

plane, and a radius vector length of 3.4 units or 0.34 millivolts. The T vector points downward, to the right and cephalad. The QRS and T vectors have an angle of  $134^{\circ}$  between them. The P vector may be expressed as  $1.4 \stackrel{!}{\underline{i}} - 0.8 \stackrel{!}{\underline{j}} + 0.16 \stackrel{!}{\underline{k}}$ . The vector may also be expressed as having an azimuth angle of  $-79^{\circ}$  from the left arm (rotating from the left arm toward the tail) in the L plane, an angle of depression of  $60^{\circ}$  below the L-plane, and radius vector length of 1.6 units or 0.16 millivolts. The P vector points

ventrally, caudally and slightly to the left.

In the E calves there was a greater variability in leg lead potentials recorded from calf to calf than were found

in the scapular lead potentials.

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The choice of planes depends on the experiment, anatomical considerations and geometrical configurations. The mid-sagittal or M plane is through the interscapular space, the lumbosacral border, and the sterum. The Lplane is through the insertions of the forelimbs and left rear limb. The S-plane is through the prescapular region, and the forelimb insertions. The limb leads were chosen on analogy with the important limb lead plane in man, and because experience indicated that the limb leads, although yielding electrocardiographic complexes difficult to interpret and analyze, provided valuable third dimensional information. The semisagittal (SS-) plane was through the prescapular space, the left forelimb and the left hind limb. For many 500-800 pound calves the QRS axis lies in or very near the semisagittal plane and maximum potentials are frequently recorded in semisagittal leads and a maximum QRS component is frequently obtained.

The average QRS angle in the S-plane shows little change between 500 and 800 pounds. The QRS angles showed a difference between lines but not between sexes. All Prince calves except two had low values in the S-plane at both 500 and 800 pounds body weight. Both aberrant calves were chronic bloaters, and one died before attaining 800 pounds. Microfilm \$2.00; Xerox \$5.60. 115 pages.

STUDIES ON THE RAT DURING AND AFTER THE INDUCTION OF HYPOTHERMIA WITH SUBSEQUENT CARDIAC ARREST.

(L. C. Card No. Mic 59-3826)

Paul W. Willard, Ph.D. State University of Iowa, 1959

Chairman: Assistant Professor B. A. Schottelius

In order to elucidate specific information about the induction of hypothermia in animals with subsequent cardiac arrest, four studies were undertaken:

(1) Electrocardiographic and other studies on rats before and after cardiac arrest induced by hypothermia

and asphyxia.

Eighteen rats were induced into hypothermia by the closed container technique to determine the effect of extreme reduction of body temperatures on the electrocardiogram. Complete cardiac arrest was obtained for an average time of 44 minutes with periods of "suspended animation" averaging over 90 minutes. Thirty nine percent of the animals were successfully resuscitated and survived for periods of at least two weeks. Andjus em-

ploying a similar technique for induction of hypothermia was able to secure 50% survival with similar periods of suspended animation but the duration of cardiac arrest in his studies was not stated. Survival could not be predicted from the electrocardiographic record. The ventricular activation time showed an inverse relationship to the temperature. The QTc decreased with cooling and increased with warming. The heart rate decreased exponentially when the rats were cooled and apparently also increased exponentially when warmed.

(2) Blood analyses of asphyxiated hypothermic and

asphyxiated normothermic rats.

Two groups of rats were subjected to the cooled, closed container technique of asphyxiation for induction of hypothermia, one group was further cooled until cardiac arrest. Asphyxiation at ambient temperature for purposes of experimental control was carried out on two additional groups of animals. Cardiac arrest was produced in one of the control groups by subsequent cooling. Blood samples were obtained by cardiac puncture either at the time of removal from the container or at the time of cardiac arrest in those animals cooled to that state. The tissues in all groups extracted oxygen; however, this does not indicate whether the oxygen was available in adequate quantity for sustaining metabolism. Cardiac arrest was obtained without fibrillation. Therefore, the acidosis observed in all animals does not appear to predispose the rat to ventricular fibrillation. Serum Na+ levels decreased, while serum K+ levels increased in a proportionate amount. These facts have been discussed in relation to the electrical activity of the heart during the induction into hypothermia with subsequent cardiac arrest.

(3) Oxygen consumption of asphyxiated hypothermic

and normothermic rats.

Oxygen consumption was measured continuously in two groups of animals, (HAH), hypothermic asphyxiation followed by hypothermia and (AAH), ambient asphyxiation followed by hypothermia, during the induction of hypothermia with subsequent cardiac arrest. One-hundred per cent of the animals were revived from this state of "suspended animation"; however, no long term survival was attained apparently because of some irreversible central nervous system damage. A linear relationship existed between the O<sub>2</sub> consumption and temperature for group HAH until a break was noted in the data at about 25°C, which suggested an alteration in metabolism of the animal at that temperature. Hypothermia in combination with hypercapnia and anoxia caused a greater depression of oxygen consumption than did asphyxia alone.

(4) Oxygen consumption by heart tissue slices from hypothermic, asphyxiated hypothermic and normothermic

rats

Cardiac tissue  $Q_{02}$  (ul/mg. dry tissue/hr.) was measured in a control group (37°C rectal temperature) and three experimental groups of animals; (HAH), hypothermic asphyxiation followed by hypothermia; (AAH), ambient asphyxiation followed by hypothermia and (H), subjected to immersion hypothermia without any previous conditioning. Control  $Q_{02}$  was measured at 37°C and the three experimental  $Q_{02}$ 's at 5°C. There was a depression in the  $Q_{02}$  of the three experimental groups from the average control value (4.91±0.32). There were no significant differences between experimental groups, however the data suggests that immersion hypothermia without any previous asphyxiation results in a larger  $Q_{02}$  than groups HAH and AAH. Microfilm \$2.00; Xerox \$5.60. 115 pages.

### POLITICAL SCIENCE

### POLITICAL SCIENCE, GENERAL

THE GOVERNMENT OF THE PROTESTANT EPISCOPAL CHURCH IN THE UNITED STATES OF AMERICA: CONFEDERAL, FEDERAL, OR UNITARY?

(L. C. Card No. Mic 59-3050)

James Allen Dator, Ph.D. The American University, 1959

The purpose of this study is to determine whether the formal, Constitutional structure of the government of the Protestant Episcopal Church in the United States of America is confederal, federal, or unitary; that is, whether, according to its written Constitution, ultimate political control for the Church rests in the dioceses severally, or is divided between the dioceses and the General Convention, or is vested in the General Convention alone.

The methods used in resolving this problem are primarily analytical and historical, and follow these steps:

Material is presented to show conflicting opinions regarding the Constitutional structure of the Church's government. Prima facie evidence supporting confederal, federal, and unitary hypotheses is presented.

Criteria for analysis, definitions of the essence of confederal, federal, and unitary governments, are developed in order to determine the formal structure.

The body of the thesis begins with an introductory examination of the Constitution and Canons of the Episcopal Church, including a statement of the historical situation of the Church during the formation of its Constitution (1776-1789), noting especially by what process the Constitution was enacted and how it may be amended.

Secondly, the structure of the General Convention of the Church is examined, showing its structural development from 1784 to the present. Special consideration is given to the questions of apportionment, membership, voting procedure, bicameralism, and the extent of the powers of General Convention.

The executive and judicial system of the Church is next discussed, including an examination of the theory of Episcopacy in the Church, the office of the Presiding Bishop and the National Council, and the system of Church courts. The relationship of the civil courts in the United States to the Church's polity is also described.

Finally, the structures of the provinces and of the dioceses are analyzed so far as they relate to the question of the Constitutional structure of the Church's government, noting especially the problems of nullification and succession, new dioceses, missionary districts, and lay membership in the Church.

A comparison of the Constitutional structure of the Church with the criteria developed shows that the formal government is unitary, with General Convention (a primarily representative body of Bishops, Priests and Laymen) possessing ultimate political control within the American Episcopal Church. The apparently federal or

confederal features (equal representation, by dioceses, and voting by orders and dioceses in the House of Deputies of the General Convention; a method of financing by which income for the national budget is secured through quotas assigned to the dioceses; an incomplete national court system; a weak "chief executive," -- the Presiding Bishoprecently made elective by the House of Bishops with the approval of the House of Deputies; and the tentative beginnings of a central administrative agency--the National Council) are offset by controlling unitary features: a Constitution not originally adopted by "sovereign" dioceses, but by representatives of the former Church of England in the several American States, which Constitution contains no division of powers between the General Convention and the dioceses, and which is amended by the action of General Convention alone; and the existence of Canonical legislation by General Convention, wholly without Constitutional permission, over the most intimate diocesan and parochial affairs. Thus, the government of the Episcopal Church is concluded to be formally unitary, even though its organization and practice is often along highly decentralized lines.

Microfilm \$4.30; Xerox \$14.40. 334 pages.

# FEDERAL CORRUPT PRACTICES LEGISLATION: A HISTORY AND ANALYSIS OF THE EFFORTS OF CONGRESS TO CURB NON-FINANCIAL CORRUPT PRACTICES

(L. C. Card No. Mic 59-2458)

Herbert Waltzer, Ph.D. New York University, 1959

Adviser: Dr. Louis W. Koenig

It is essential to the successful functioning of a representative democracy that the election process be free, or as free as possible, from corrupt practices which might injure or destroy the freedom, purity and integrity of elections.

Exercising its powers under section four of Article
One of the Federal Constitution, Congress has sought by
law to curb the use of corrupt practices at elections at
which are chosen the elected officers of the United States.
In enacting the basic ground-rules under which parties and
candidates seek election victory, Congress has dealt with
the three basic categories of corrupt election practices.
It has enacted:

- Laws designed to curb such acts as fraud, bribery, intimidation and coercion which tend to directly corrupt the exercise of the franchise and the results of elections.
- 2. Laws designed to regulate and protect the political activities of public officers and employees to

- prevent the partisan political exploitation of public office and power.
- Laws designed to curb the undue and corrupt influence of money in elections by regulating campaign finance.

This study treats the legislative history, substance, enforcement, and effects of the first two categories of Federal law. Only in the period of Radical Reconstruction has Congress attempted to fully proscribe the traditional direct corrupt practices. Moreover, the Enforcement Acts of 1870 and 1871 added an unusual system of Federal supervision of elections to enforce this comprehensive set of prohibitions. The attempt to oversee elections in the cities which were centers of Democratic strength failed to accomplish even the political objectives assigned to it by the Republicans. In 1894, the repeal of laws brought an end both to Federal supervision of elections and the prohibitions against the use of direct corrupt practices at congressional elections. Except for incidental treatment of bribery and intimidation in laws dealing with campaign finance and the partisan use of public authority, Congress has not legislated in this field in the twentieth century.

To prevent parties and candidates from exploiting or subverting the powers and prestige of the United States for political advantage, Congress has prohibited the military to influence or coerce voters, or to interfere with or participate in elections. To protect the political freedom of the serviceman-voter, it has acted to prohibit his superiors, or any other person, to attempt to influence his voting or other political acts.

The Pendleton Act and the Hatch Acts were adopted to prevent anyone holding civil office or employment under the United States to use his position to influence or coerce the political acts of other persons, or to interfere with or affect the results of a nomination or election. Congress has also sought to secure the political independence of Federal servants by prohibiting anyone to use the nature or security of their employment to induce or compel them to vote or not to vote, to vote for or against any candidate, or to make any contributions of money or anything else for political purposes.

To preserve the political independence and neutrality of the public service, Congress has acted to closely regulate the political activities of public servants. In "filling in the details" of the congressional policy that no person in Federal employ, or in the employ of any State or local agency receiving or administering Federal funds, shall take any active part in political management or political campaigns, the Civil Service Commission has established and enforced an elaborate system of personnel rules dealing with prohibited and permissible political activities. Even though it is provided that such persons retain the right to vote as they may choose and express their opinions on all political subjects and candidates, the practical effect of these regulations has been to reduce public servants to the status of spectators of the drama and comedy of politics in the United States who may silently cast their ballots at elections.

Although the nature of politics and political conditions in the United States in the mid-twentieth century are different than those which prevailed in earlier times, direct corrupt practices are still part of the "political bag of tricks" of parties and candidates. Such practices, whether they be used to corrupt hundreds of votes or one vote, do impair the freedom and honesty of elections. Perhaps Congress should re-examine the question of exercising its constitutional power and, in a comprehensive corrupt practices law, prohibit the use of such practices at national elections.

Such a law would provide a base for the prohibitions against the partisan use of public office and power. The latter practices are simply direct corrupt practices which have public authority as the source of their influence or compulsion. These laws, if adequately enforced, might also eliminate or reduce the need to impose such drastic restrictions on the political freedom of public servants. Although the recommendation that Congress adopt the British system and only remove from participation in politics those civil servants who exercise powers of policymaking or administrative discretion deserves serious consideration, it might also be worthwhile to inquire into whether the present limitations on the political freedom of public servants do not unnecessarily restrict important political rights of a significant portion of the people without providing commensurate benefit or protection to the public. Perhaps it might be more beneficial to permit and encourage public servants to express themselves on public problems and assume a normal and active role as participants, and not mere spectators, in community affairs.

Microfilm \$5.75; Xerox \$20.20. 451 pages.

### POLITICAL SCIENCE, INTERNATIONAL LAW AND RELATIONS

INTERNATIONAL LEGAL AND POLITICAL FACTORS
IN THE UNITED STATES' DISPOSITION OF ALIEN
ENEMY ASSETS SEIZED DURING WORLD WAR II:
A CASE STUDY ON GERMAN ASSETS

(L. C. Card No. Mic 59-3253) Charles Wesley Harris, Ph.D. University of Wisconsin, 1959

Supervisor: Professor Llewellyn Pfankuchen

This thesis deals with the efforts by the United States to make final disposition of alien enemy property seized during World War II, from the standpoint of international law and politics. The basic aim is to find out, as nearly as possible, what the law is on the question and the extent to which the United States has attempted to follow it. The study is divided into two parts. The first part deals with international law and the treatment of alien enemy assets. The second part is concerned with the international political factors which have influenced the handling of vested enemy assets. It is presented as a case study on German assets.

International law regarding the treatment of enemy property is not very clear. Custom and usage can be found to support both sides of the question. The right of a belligerent State to sequester and utilize alien enemy property during the course of war is generally accepted at present; the basic question is whether or not it can be confiscated.

The right and practice of confiscation of any and all goods seized during the course of hostilities was accepted in ancient times. By the time of the early modern period the exercise of this right had begun to decline. The exercise or non-exercise of the right tended to become a matter of national policy. American practice is typical of the ambiguity which has existed in the law regarding the treatment of alien enemy property in modern times. Up to World War II, however, the majority evidence is considered to be in opposition to the confiscation of alien enemy property.

During the early postwar period, American policies, both international and domestic, were developed amidst extreme war passions and animosities toward the defeated enemy. With the passage of time and the respective changes in the international situation, the United States became dissatisfied with the confiscatory policy. The split between the United States and Russia widened, whereas West Germany, in time, became allied with the West.

Since 1952, Congress has been giving almost constant consideration to resolutions dealing with the Trading with the Enemy Act and since 1954, to bills designed to return enemy property to the original owners. As of the end of 1958, no final action had been taken.

The treatment of enemy property is a legal question. A basic conclusion of the study is that despite the lack of clarity in the law on the treatment of alien enemy property, if a legal approach had been taken from the outset, rather than one which was largely political and characterized by domestic influences, the issue would not have been beset by the various shifts in the international political situation. Whether the law had been found to support or deny confiscation is not considered to be the important point. If the aim had been the ascertainment of the current law on the question and to carry it out, the United States would have been operating on a much more stable basis for a final settlement of the issue.

Microfilm \$5.10; Xerox \$17.00. 399 pages.

PRACTICE AND PROCEDURE IN PREPARING FOR INTERNATIONAL CONFERENCES WITH SPECIAL EMPHASIS ON UNITED STATES TECHNIQUES

(L. C. Card No. Mic 59-3015)

Donald Cameron Hester, Ph.D. University of Maryland, 1959

Supervisor: Dr. Elmer Plischke

Research on this subject was undertaken with several explicit aims in view. The primary objective was to examine available materials concerning procedures pursued throughout the history of international gatherings in which the United States participated. Additional purposes were to present a new and fuller account of conference preparations than has been given by previous authorities and to supplement their works with an up-to-date survey of essential procedural details and to evaluate the findings. It was hoped that significant conclusions might be reached which would evoke specific recommendations for improving international conference preparations.

Historically, conference procedures have evolved from

the conduct of negotiations on a bilateral basis--predominantly political in nature--to the current multiplicity of international gatherings of a multilateral nature. The numerical increase has been occasioned and accompanied by a parallel increase in the diversity of subjects of interest as scientific progress has prompted international concern with both technical and political problems. There followed a period of separation of political and scientific considerations--with governments handling the political and cooperating with but not dominating those concerned with scientific advancement. Currently most conferences have both political and technical implications--with governmental policy tending to dominate the scientific and technical developments as well as the political.

Conferences may be initiated by one or more governments, individuals, professional groups, international organizations or a combination of these agents. Sponsorship and inviting authority tend to go hand in hand, though there are exceptions. Present trends are toward joint invitations and universal membership—a decided change from the days when the great powers alone made most international decisions.

The findings indicate that the increased number and complexity of conferences have placed added burdens on governments. These are offset somewhat by improved procedures developed through experience and modern technology. Rapid means of communication and travel have facilitated both conference preparation and participation. An efficient secretariat is indispensable to the successful operation of a conference. A significant advance in United States preparatory procedures was the establishment of a Division of International Conferences whose highly systematized and efficient procedures embrace all preparatory details. Pre-conference circulation of the provisional agenda, accompanied by an expression of views of interested powers, is essential to harmonize divergent opinions of participants and to allow ample time for study. The predominance of international organizations, meeting at regular intervals, and the waning of ad hoc conferences have introduced new elements into conference procedure. These permanent international entities are analogous to legislative bodies both in their recurring sessions and in their approach to problems.

Because the date and place of a conference--especially political conferences--may well determine its success or failure, great care is exercised now to assure both an auspicious time and site. Government sponsorship often is associated with domestic problems and may be used for propaganda purposes. It is necessary at times to wait for democratic opinion to catch up with political developments or to "educate" the public to accept the convening of an unpopular conference.

Weaknesses are apparent in overcrowded agenda, heavy documentation, and acceptance of last-minute (surprise) agenda items. This is especially true in large organizations such as the United Nations and its Specialized Agencies. Diplomacy by means of conferences generally is more public than bilateral negotiation. Because of this, perhaps, the United States sometimes tends to adopt an inflexible posture that limits its area of maneuverability with a corresponding lack of dynamic and creative policy.

On the whole, however, practice and procedure have reached a high degree of efficiency which contributes to the substantive success of conferences. Often the outcome of a conference and the achievement of national objectives depend as much on effectual preliminaries as on negotiations themselves.

Microfilm \$7.00; Xerox \$24.20. 552 pages.

### THE POSITION OF IRAN IN CONTEMPORARY GREAT POWER POLITICS

(L. C. Card No. Mic 59-2336)

Cyrus H. Khabiri, Ph.D. The American University, 1959

This dissertation has attempted to analyze the contemporary politics of the great powers in Iran with respect to the political warfare aspects of the subject. In the course of the study it has been revealed how British, Soviet and American tactics have been directed in Iran since the Second World War. The role each power has played to obstruct the others in the pursuit of their national and strategic interests is examined.

An effort is made to present the basic responsibilities of Iran to meet the influence of great power politics. It is recommended that Iran must count more heavily on its own resources and the strength of its geopolitical position. There is no substitute for the application of national enterprise, either by aid from the United States or from a Communist program. The impetus and drive toward reform and development must come from within Iran.

It is concluded that the Iranian policy toward Great Britain must be dictated by the aim of removing the causes of friction, by the efforts to wipe out the memories of old quarrels, and by placing Anglo-Iranian relations on a footing of better understanding. With respect to the Soviet Union, the traditional attitude of hostility and the policy of irreconcilable conflict between Iran and the U.S.S.R. must be subjected to more careful scrutiny. The Iranian policy, marked by the desire of friendly relationship with the United States, should be continued.

It has been concluded that Iran must pursue a policy of "tolerance" in East-West disputes and not hastily join the issues of great power politics to prevent new areas of tension from developing.

Microfilm \$3.00; Xerox \$10.20. 230 pages.

### THE CULTURAL INSTITUTE IN MEXICO CITY AS AN EXAMPLE OF UNITED STATES POLICY IN CULTURAL RELATIONS

(L. C. Card No. Mic 59-2941)

Donald H. Scott, Ph.D. University of Southern California, 1959

Chairman: Professor Berkes

After 1933 the United States abandoned its interventionist policy in Latin America and adopted the Good Neighbor Policy. An integral part of this policy was the cultural relations program. Supervised by the Department of State from 1938 to 1953, it provided for the exchange of persons, the distribution of American books, music, and

art, and assistance to American-sponsored libraries, schools, and cultural institutes.

The Mexican-American Cultural Institute in Mexico City served as a center for many aspects of this program. It was administered as a cooperative, educational, and recreational institution under a binational board of directors and American foreign language teachers. Its principal activity consisted of teaching English to Mexicans, but it also offered a number of related courses, seminars, and services to Mexican educators and other selected groups. Its educational program was supplemented by various intellectual, cultural, and social activities for students and adults of both nationalities. The institute also participated actively in the exchange-of-persons program and in the formation and operation of the Mexico-United States Commission on Cultural Cooperation. The evidence available points to the effectiveness of the institute from the educational point of view.

It was the purpose of United States policy toward Latin America to establish cooperative relationships that would contribute to the political, economic, military, and moral strength and unity of the Western Hemisphere and ultimately to the security of the United States in peace and war. It was particularly believed by some that cooperative, reciprocal, and nonpolitical cultural relations would contribute to peace through mutual understanding. Others viewed the program as a unilateral American propaganda device designed to create favorable attitudes toward the United States in time of war. As examined by the present investigator, however, the record of the Cultural institute in Mexico City from 1942 to 1953 fails to substantiate significantly

either of these two theories.

As a propaganda device the actual and potential use of the institute was limited. It disseminated some factual information about the United States and some mild "cultural propaganda" emphasizing hemisphere solidarity, mutual understanding, and cooperative relationships. Its administrative structure, financial support, and publicity channels, however, prevented any monopoly of control by Americans, and it responded slowly to guidance from Washington. Moreover, Mexicans were largely unconcerned with the general welfare and international problems of the United States, and they expressed aversion to the political orientation of cultural activities and their unilateral administration by Americans. These factors suggest that the institute could have exercised little, if any, effect on Mexican political opinions.

Similarly, the apparently limited amount of political influence and mutual understanding resulting from the institute's activities indicates that cultural relations could scarcely have contributed significantly to peace between the United States and Mexico. Furthermore, whatever beneficial effects cooperative administrative procedures may have had on Mexican attitudes, the evidence suggests that the decisions of Mexican officials were influenced less by such procedures than by consideration for the welfare of Mexico.

Changing circumstances and opinions caused some adjustments in both the rationale and the administration of the program as the world situation fluctuated between peace and war, but the essentially educational nature of the institute remained unaltered for a decade. The expansion of its activities, increased attendance figures, cooperation by Mexican officials, and persistent efforts by Mexican educators to influence its policies attest to its

educational value to Mexicans. Although Mexicans were primarily interested in American professional, scientific, technical, vocational, and educational knowledge and in tangible benefits to themselves, Mexico demonstrated its desire to reciprocate with a cultural relations program of its own. Accordingly, it is estimated that the American program encouraged and facilitated a variety of binational relationships based on interests which were more influential than either the propagandistic aspects of the program or mutual understanding in determining the policies of Mexico toward the United States.

Microfilm \$14.85; Xerox \$53.20. 1179 pages.

AN ANALYSIS OF THE POWER INVENTORY OF STATES AND NATIONAL STRATEGY AND THEIR INTERRELATIONSHIP IN THE CONTEXT OF INTERNATIONAL POLITICS

(L. C. Card No. Mic 59-3055)

Edgar Raymond Terry, Ph.D. The American University, 1959

The United States annually spends large sums of money for the collection, evaluation, and dissemination of enormous quantities of factual data on foreign States and peoples. This expenditure is justified on the grounds that the effective conduct of foreign affairs requires precise and detailed knowledge of the power inventory, -- i.e., the actual and potential power position expressed in terms of geography, resources, population, economic and political institutions, customs and civic attitudes, and other elements, tangible and intangible, -- of other States, particularly in relation to the United States. However, in general, analysts and students of international politics studying these categories or elements individually, fail to have an appreciation of the whole, an understanding how particular data gathered and assessed ultimately compose the power inventory. This is due in part to superficial knowledge of certain theoretical and methodological contributions to the study of international politics; yet the views expressed in these contributions are in the main uncritically taken for

In an examination of some of the more outstanding theoretical and methodological contributions to the study of . international politics one thing is clearly discernable: there is a strong tendency to stress one element of the power inventory -- a variable -- and treat it as a determinant, either neglecting the remainder or failing to integrate and show how closely interrelated each element is with one another. The problem here is, in part, of determining the frames of reference, approaches, interests, and methodologies employed in the formulation of these hypotheses as the Sprouts have clearly shown; and it is in part a problem of "relative weight" in making a "recipe for a composite view" as Stephen B. Jones has ably demonstrated. Thus agreement and clarity of statements end when one attempts to identify, classify, and assign weight to the various elements that make up the sum total, i.e., the power inventory, and to date no suitable framework for the ordering of these elements has proven satisfactory.

Yet, contrary to a sometimes almost cynical and rather widespread belief, the capabilities of a State and of

international relationships, cannot be viewed as simply pure guesswork. Each of the elements that have been stressed by various theorizers could be considered collectively as a basis of the capabilities of a State; and it can even be demonstrated that the power inventory remains a relevant concept in a Nuclear Age. However, in the last analysis, it is not so much the capabilities of a State per se that matter, but its capabilities in relation to those of other States, i.e., its power position. Furthermore, a continuing re-evaluation of a State's capability is essential because of the continually changing international political scene, necessitating a determination of the specific form of power to be brought to bear in a particular situation. The power of the United States, for example, to induce the General Assembly of the United Nations to adopt Resolution X will in many instances differ from its power to induce either Resolution Y and/or Z, because in this hypothetical case, the power of the United States to influence opinions abroad differs among the various States and/or blocs of States on various issues at various times. Even when viewing the study of the power inventory of States negatively, -- i.e., the attempt to reduce the power inventory of a State to a simple mathematic straight-line equation, -- if it demonstrates nothing more than the complexity of the problem, it is of value for this alone. Thus in addition to the study of the elements that make up the power inventory something else is needed.

Certain general guides should be considered as a supplement in any determination of the power inventory of a State, for they may give an indication to the analyst and student of international politics how a particular State is going to act at a specific time under certain imposed conditions. International law and organization could serve as guides, although admittedly perhaps from a negative point of view. Pitman B. Potter has effectively demonstrated that as national policies become embodied in international law and organization they cease to be merely national foreign policies. As one item after another in the foreign policy programs of various States is transferred to the agenda of an international conference or the list of functions of an international commission, international politics tend to become obsolete, as international law and organized international cooperation become broader, deeper, and more effective. However, until this comes about, the actions, reactions, and interactions between and among States as observed at international conferences or in other forms of international intercourse, will serve as valuable adjunct to the power inventory for determining flexible strategies.

Microfilm \$3.55; Xerox \$12.00. 274 pages.

POLITICAL SCIENCE, PUBLIC ADMINISTRATION

ORGANIZATION AND POLICY CONTROL FOR SCIENTIFIC RESEARCH AND DEVELOPMENT IN THE FEDERAL GOVERNMENT

(L. C. Card No. Mic 59-2973)

Charles William Fotis, Ph.D. The American University, 1959

This study focused attention on the organizational structure for policy control for scientific research and development in the Federal Government. Because of the general broad scope of the inquiry, it was limited to organization, administration, and program operations of certain departments, agencies, and offices of the Executive Branch of the Government considered to be sufficiently representative of the Federal scientific effort. Special attention was given to the Department of Defense in which the activities of the Office of the Secretary of Defense level, Air Force and the Air Research and Development Command were examined. The degree to which present organizational arrangements are geared for providing adequate attention and review of unique problems of science was investigated. An analysis was made of the roles of the Bureau of the Budget, Interdepartmental Committee on Scientific Research and Development, National Science Foundation, and National Academy of Sciences - National Research Council in the formulation of a National science policy.

Material used in this inquiry included both primary and secondary sources. They included official as well as non-official sources, hearings, and such reports as the Hoover Committee, Riehlman Committee, and Rockefeller Committee. The historical, analytical, descriptive, and comparative methods were employed. Extensive interviews were held with numerous competent persons directly involved in the Nation's scientific effort.

However measured, scientific research and development work supported by the Federal Government represents a tremendous undertaking and has been growing larger each year. It is a matter of record that responsible citizens have voiced their concern over the lack of a National policy as it affects scientific research and development. Furthermore, serious questions have been raised as to the adequacy of the present mechanism for formulating over-all governmental research and development policies which take into account both the total needs of the Federal Government and the place of the Federal program in the total National program.

The rapidity with which science has emerged as partner in the military security program of the Nation has led to numerous changes in organizational patterns for decision-making and considerable adjustment in the administration of research. Evidence supports the existence of a continual struggle in which the logistic functions attempt to dominate and control the research and development functions of the military establishments. Evidence further supports the conclusion that military organizations tended to create conditions which retarded the work of scientists.

Each of the other departments and agencies studied has organized its research and development activities in light of circumstances peculiar to that department. There appears to be an extension of the use of advisory groups as a central coordinative mechanism in scientific research and development program administration.

Modern government must give adequate recognition to the profound importance of the relationship of science to government, if it is to contribute effectively to the advancement of human dignity and personal liberty. Criteria for adequate National science policy need to be carefully studied and formulated. Organizational patterns for decision-making and administrative machinery for Federal scientific research and development programs need to be clearly understood and geared into the budgetary legislation and other administrative processes of the government if a worthwhile National science policy is to be evolved, sanctioned, and effectively applied.

Microfilm \$4.75; Xerox \$16.00. 372 pages.

CONGRESSIONAL REVIEW OF ADMINISTRATIVE DECISION-MAKING BY COMMITTEE CLEARANCE AND RESOLUTIONS

(L. C. Card No. Mic 59-2646)

William Emmerette Rhode, Ph.D. Michigan State University, 1958

Supervisor: Glendon A. Schubert, Jr.

This study presents a description and analysis of a particular method of congressional oversight of certain types of administrative decisions. Such congressional oversight provides a means of legislative review of the use of administrative discretion. It is composed of the two devices of review by resolution and committee clearance. The first is represented by those statutory requirements that subject particular administrative decisions either to legislative approval by affirmative concurrent resolutions or to possible legislative nullification by simple or concurrent resolutions. The second device is composed of those statutory requirements and informal agreements that subject administrative decisions to the review and clearance of specified standing congressional committees.

Congressional oversight represents an institutionalization of the doctrine of "Legislative Control," which is one of the three current schemes offering alternative solutions to the problem of the proper control of administrative discretion. The description and analysis of this practice is thus cast within the theoretical context outlined by these dominant doctrines. They are the doctrine of "Presidential Control," the doctrine of the "Judicial Formula," and the doctrine of "Legislative Control." The first points to the President to provide the necessary control of the discretionary powers of the American bureaucracy. The second doctrine emphasizes the necessity to structure the administrative process after the judicial model in order to limit and control the use of administrative discretion. The third concludes that the legislative body is the proper organ of control and direction of administrative discretion.

The genesis of each of these doctrines is found in the ideas and thoughts of three early pioneers in the formulation of the disciplines of public administration and administrative law, Frank J. Goodnow, Ernst Freund, and William F. Willoughby. The early schemes for the control of administration represented in the writings of these men are presented and their relationships to the current doctrines are analyzed and emphasized.

The British practice of parliamentary supervision of subordinate legislation is also described in order to furnish a basis of comparison with the American method of legislative oversight. The British practice was established to provide a means of parliamentary control over the uses of the delegated legislative powers of the British governdment. While it is similar to the American method in that it points to the legislative body as the proper source of control, it displays several significant differences in both formal aspects and actual operation. These differences are presented and discussed.

The detailed description and analysis of the American method is composed of several elements. The description centers around an enumeration and discussion of the instances of the statutory establishment of both review by resolution and committee clearance. In the case of committee clearance, however, this survey is complemented by a presentation of several instances of the establishment of this device which are based upon informal agreements between particular congressional committees and executive agencies.

The analysis focuses upon the actual operation of the American practice. In the case of review by resolution, the role and influence of the regular legislative committees is emphasized. In the case of committee clearance, the reviewing practices of those committees presently engaged in the review and clearance of administrative decisions is the central concern. Such reviewing practices result in the defacto delegation of the clearance function. The delegations fall into three general patterns which are presented and discussed.

The analysis also includes a survey of the various arguments that have been presented to support or oppose the constitutionality of each device. This survey is accompanied by a systematic consideration of the major constitutional issues raised by both devices.

Finally, a general evaluation of the two devices as responsible tools for the control of administrative discretion in a democracy is made. Both offer certain advantages to the legislative body and the executive agencies. In the case of committee clearance, however, as contrasted with review by resolution, these advantages are outweighed by the fact that the former device does not place the final approval or disapproval of administrative decisions at a point in the governmental structure which assures that such final clearance will represent and reflect the consent of the governed. It does not represent, therefore, a promising device for assuring the responsible control of administrative discretion.

Microfilm \$5.00; Xerox \$16.80. 392 pages.

### EVALUATION OF EFFECTIVENESS OF SCIENTISTS AND ENGINEERS IN A GOVERNMENT LABORATORY

(L. C. Card No. Mic 59-3051)

Sam Rothman, Ph.D. The American University, 1959

In recent years there has been a great deal of discussion concerning shortages of scientific and engineering manpower in the United States. Regardless of the conclu-

sions reached, the fact remains that management should optimize the effectiveness of its scientific and engineering personnel. As a prerequisite to the establishment of techniques for increasing effectiveness there must be a logical and effective evaluation procedure. This study investigates techniques currently being used to evaluate the contributions of scientists and engineers and also considers possible "guideposts" by which productivity may be measured. To investigate these problems, data were obtained from the staff in the Research Department at the U.S. Naval Research Laboratory (NRL) in Washington, D. C.

Publications, awards, financial income, etc. are some factors used informally by supervisors as criteria in their appraisal of technical subordinates. Personnel records at NRL were examined with a view toward assessing the validity of these factors. Publication records for 1952 and 1957 were examined. Financial compensation, rate of advancement, age, and degree status were determined for authors of technical papers and compared to the average employee. These factors did not correlate with the exception that authors of more than one paper published in 1952 or 1957 were promoted at a slightly faster rate than the average professional employee.

As a step in evaluating this overall problem, it was sought to determine how scientists and engineers would rate their peers. Questionnaires were distributed to 300 professional employees at NRL. Two hundred and forty non-administrators were asked to evaluate their colleagues, and sixty administrators were asked to evaluate their subordinates. The questionnaire asked each respondent to name the most effective individual and explain why this decision was made by ranking appropriate statements and/or replying to an open-ended question. A statistical analysis of the data clearly showed that the administrators and non-administrators considered the same factors most and least important in evaluating laboratory personnel and gave greater importance to subjective factors than to objective factors. This situation was consistent regardless of technical field, age or degree.

After one has determined which approach to use for evaluation procedures, it is important to examine the various techniques which could be used to accomplish the purpose. Technical training and status are two critical aspects. The former includes both external formal university cooperative programs and internal formal and informal programs. The latter is concerned with salary, prestige, etc. NRL is aware of the need to continue a strong program to increase the effectiveness of its personnel and maintains a strong university-government cooperative curricula. Management's approach to the status problem is by means of increased salaries, awards, etc.

The study results in two basic findings supported by analyses of personnel records and of replies to a peer assessment questionnaire:

(1) Objective factors, such as publications, awards, and reports should not be primary considerations in the evaluation of scientists and engineers at a laboratory like NRL. Subjective factors, which include ability, team approach, etc. should be given important consideration.

(2) Both administrators and non-administrators at NRL considered the same factors as most and least important in the evaluation process.

Microfilm \$2.95; Xerox \$10.20. 226 pages.

THE EFFECTS OF AUTOMATIC DATA
PROCESSING SYSTEMS ON THE JOB STRUCTURE
OF THE FEDERAL GOVERNMENT

(L. C. Card No. Mic 59-3053)

Lawrence Godfrey Woodward, Ph.D. The American University, 1959

The primary purpose of this research was to describe automatic data processing jobs and to determine an appropriate job classification and grade structure for those in the Federal Government. Secondary problems included a review of the types and levels of jobs changed or eliminated, and the personnel problems concerned with recruiting, selecting, placing, training and organizing ADP employees.

A review of the literature showed that there was very little information on the specific problems. Therefore, the principle method used was field inspections and interviews with ADP officials and personnel officers.

Since the Federal Government is the largest single user of computers, their introduction has had a large impact on those personnel directly concerned with ADP installations. Officials in ADP units named personnel problems as a major factor in preventing the units from achieving the efficiency they believed possible. All concerned agree that the installation of automatic data processing takes many man-years of the best planning by the highest available talent.

Once established, there is a tendency to combine organizational units involved in data processing. This resulted in the elimination of about 900 GS-2 and -3 clerical jobs in the fifteen units surveyed. However, only about twenty-five people were left unemployed since the installation of ADP takes long enough to permit training for new ADP jobs or other jobs.

Five major occupations have been created by automatic data processing: systems analyst, programmer, systems operator, peripheral equipment operator, and ADP administrator. These new jobs have increased at a very rapid

rate, numbering 6,055 on 31 March 1958, and with a predicted growth to 15,000 by 1963. This growth has taken place so rapidly that ten per cent of the jobs are unfilled. Many of these are key positions.

The history of the development of position classification standards by the Civil Service Commission was presented. In a survey of ADP units almost all of the respondents indicated satisfaction with the standards and the grades established. However, evidence indicated that salaries in the middle and upper grades were not close to those paid by industry. Therefore, turnover is a problem,

especially of key personnel.

Since business-type data processing requires a large element of substantive knowledge, most systems analysts and administrators are recruited from within the organization. To a lesser extent, this is true of programmers and operators. Evaluation of candidates' education and experience and personal interviews are believed by ADP supervisors to be the most important selection methods. Although tests are widely used, at the time of the research, only in one case had a thorough validation study been made.

Between 1958 and 1961 it is estimated that almost 40,000 people will receive ADP training. However, only about five per cent of this training will be conducted by universities.

It appears that many business, industrial and governmental organizations will install automatic data processing systems. However, it is too early to assess the long-range impact of these systems on organization.

Officials responsible for ADP units should take advantage of the authority to hire above minimum rates; enter into special training and promotion agreements, and make use of the new Government Employees Training Act to ease personnel problems. But the ultimate answer applies to all occupations in critical supply in the Government. The solutions to these appear to be an increase in fringe benefits and the adoption of a prevailing wage system to meet competition given by private business.

Microfilm \$5.05; Xerox \$17.00. 396 pages.

#### **PSYCHOLOGY**

PSYCHOLOGY, GENERAL

AN EVALUATION OF THE EFFECT OF LEVEL OF ITEM DIFFICULTY ON VARIOUS INDICES OF ITEM-DISCRIMINATION

(L. C. Card No. Mic 59-3145)

James Frederick Adams, Ph.D. State College of Washington, 1959

This study has investigated the effect of item difficulty level upon the reliability of the following item analysis methods: the U-L 27% method, the U-L 10% method, phi, tetrachoric r, tetrachoric r corrected for non-median dichotomization, biserial r, point biserial r, the t-ratio, and the discrimination index. Also considered were the

effect of item difficulty level on the validity of test items and the interrelationships between item analysis methods.

The final examinations from each semester of a two semester course in introductory psychology were obtained for purposes of item analysis. In the first semester two groups of subjects were empirically equated on the basis of total test score (the criterion). The reliability of methods was established by correlating the results obtained between equated groups for difficulty subtests characterized by items which were passed by 0-40%, 41-60%, 61-80%, and 81-100%. A replication of procedure was followed with the second semester examination.

The results of this study may be summarized as follows:

1. The reliability for every method of item analysis is the lowest for the easiest items.

- 2. Items in the middle range of difficulty have the highest method reliability followed closely by items at the 61-80% level of difficulty.
- 3. There are no significant differences between method reliability coefficients for the most difficult items.
- 4. In the 41-60% category, biserial r, point biserial r, and the t-ratio have the highest method reliability. The same is true for the 61-80% category.
- 5. There is little difference between the reliabilities of methods in the 81-100% category.
- 6. The methods which compare the least favorably with respect to method reliability are the U-L 10% method, tetrachoric r, and tetrachoric r corrected for non-median dichotomization.
- 7. The U-L 27% method, phi, biserial r, point biserial r, and the discrimination index produce quite comparable method reliability coefficients at all difficulty levels.
- 8. When the mean values of validity indices are examined, the U-L 27%, the U-L 10%, tetrachoric r corrected for non-median dichotomization, and biserial r reveal similar characteristics at all difficulty levels. Phi, point biserial r, and the t-ratio also show the same difficulty level characteristics.
- 9. The shape of the criterion score distribution should be given careful consideration before relative emphasis is assigned to validity coefficients at differing levels of difficulty. Although certain methods of item analysis are theoretically independent of item difficulty level, every method examined is affected by the shape of the criterion score distribution regardless of the assumptions concerning this variable.
- 10. Intercorrelations between item analysis methods revealed that point biserial and the t-ratio come very close to being correlational identities and are the most representative of the methods examined.
- 11. Item difficulty level was found to be quite reliable when computed using the total N or when computed using the upper and lower twenty-seven percent of the cases.

  Microfilm \$2.00; Xerox \$5.60. 115 pages.

AN EXPERIMENTAL TEST OF THE SUPERIORITY AND THEORY OF FORCED-CHOICE QUESTIONNAIRE CONSTRUCTION

(L. C. Card No. Mic 59-2437)

Valentine Appel, Ph.D. New York University, 1959

Adviser: James N. Farr Co-Sponsor: Raymond A. Katzell

The forced-choice method is a technique of questionnaire construction the purpose of which is to increase the
validity of a subject's responses by controlling his tendencies toward conscious or unconscious distortion. This
is accomplished by presenting the respondent with two
items (a discriminator and a non-discriminator) of equal
preference value but of differing validity. By forcing him
to choose one of the two items as more descriptive of
himself, it is presumed that his tendency to distort is
thereby reduced. To date, however, little evidence has
been presented to indicate that this method is superior to
the more conventional true-false questionnaire methods.

One theory has recently been advanced to account for the presumed increased validity of the forced-choice method. This theory is one which has recently been advanced by Brogden, and which treats the non-discriminator in the forced-choice pair as a suppressor variable. According to this theory, "...the success of the technique is due to the fact that the invalid alternative reduces the distortion variance by suppressor action," and thereby raises the validity of the item pair (6, p.142).

The purpose of the present study was to provide evidence relative to the superiority of forced-choice vs. true-false methods of questionnaire construction, and also to provide an empirical test of the Brogden theory.

Following an exhaustive item analysis a forced-choice questionnaire and a parallel true-false questionnaire were constructed having identical item content. The true-false form consisted of 72 items presented singly, and the forced-choice form consisted of the same 72 items presented in the form of 24 blocks of three items each. Each block contained three items:

- 1) A discriminator (a valid item for predicting an academic grade criterion).
- A suppressor (an item of zero validity but correlated with the discriminator).
- 3) A non-discriminator (an item of zero validity which was uncorrelated with the discriminator).

For each block each subject was required to choose one item as most descriptive and one as least descriptive of himself. The forms were administered to 809 students at four New York City colleges, half of them being administered the forced-choice form and the other half the truefalse form.

When the validities of these forms were computed against the academic grade criterion it was found that:

- 1) The forced-choice form when scored with the discriminators paired with the suppressor items had a significantly lower validity (r = .26) than did the same discriminating items when scored with the paired non-discriminators (r = .42). The reason for this is attributed to the regression of item validity of the suppressor items in the cross-validation sample.
- 2) The discriminator items when presented in true-false format did not differ significantly in validity (r = .39) from the forced-choice form when scored with the discriminators and the paired non-discriminators (r = .42).
- 3) There were significant differences, however, in the homogeneity of the items comprising the true-false and the forced-choice forms. Accordingly the forecasted validities for the best keys of the two forms for an infinite number of items were calculated to be .57 for the true-false form and .74 for the forcedchoice form.

It was concluded, therefore, that the question of the relative validity of forced-choice vs. true-false methods of questionnaire construction must be looked upon in terms of the number of items which can reasonably be included in the form. For longer forms the forced-choice method is likely to result in greater validity; for shorter forms the true-false method is likely to prove superior.

It was further concluded that the major advantage of the forced-choice method lies <u>not</u> in the original hypothesis that the suppression of non-valid variance in an otherwise valid item <u>raises the validity</u> of the par. Rather the chief advantage lies in the <u>lowering</u> of the average intercorrelation among the valid items.

It is also suggested that the risk of the regression of item validity in the case of suppressor items be kept in mind when constructing forced-choice pairs. A procedure is therefore suggested which is based upon the pairing of discriminating and non-discriminating items which are uncorrelated with each other. In this way the risk involved in having the non-discriminator develop validity upon cross-validation is minimized.

Microfilm \$2.00; Xerox \$4.00. 72 pages.

### EFFECTS OF PARTIAL REWARD ON SEVERAL INDICES OF GROUP BEHAVIOR

(L. C. Card No. Mic 59-3073)

Delaney Andrew Dobbins, Ph.D. Louisiana State University, 1959

Supervisor: Professor Bernard M. Bass

The purpose of this investigation was to determine the effects of differential percentages of reward on the verbal interaction and member attractiveness of small discussion groups engaged in problem solving tasks. The research attempted to extrapolate the effects of partial reinforcement found in individual learning behavior of both lower animals and humans to a more complex behavioral level.

Ss were 150 Negro male delinquents between the ages of 14 and 16. Thirty discussion groups of five boys each were assembled. The basic acquisition-extinction experimental paradigm was modified for use within the leader-less group discussion framework. Ten groups received a monetary reward for all five (100%) problems during the acquisition series, another 10 groups received 40% reward, and a control group received no reward. Each of the three treatment groups received five extinction trials. Problems consisted of attempts to rank five major league baseball players according to their previous year's batting averages. Group decisions following discussion were rewarded according to the above schedule regardless of actual accuracy.

Attraction to the group was measured by a questionnaire administered following the practice problem and a similar questionnaire following the last problem.

Three observer-recorded measures of the amount of verbal interaction or participation were used: frequency, time spent talking, and time to reach the group decision. No time limits were placed on interaction.

The major hypothesis of the study predicted that partial reward would maintain a significantly higher level of verbal interaction during the post reward series than either fully or non-rewarded groups.

The hypothesis was not confirmed. Results indicated that reward schedule had no significant effect on any of the three interaction measures during either the reward or post reward series. However, weak partial reward trends emerged during the last two trials; frequency and

time spent talking were significantly higher for the partial than no reward groups and non-significantly higher than fully rewarded groups.

A subsidiary hypothesis predicted that post-test group attraction would be greatest for the partial reward group.

The hypothesis was not confirmed. Analyses revealed that post-test group attraction was significantly higher for the full reward groups, followed by partial and no reward. However, no significant increment in attraction was found favoring the partial over the no reward groups. By content analysis it was inferred that post-test differences in attraction were rationalizations directed at lack of information on the part of other members and not at the task, experimenter, or member motivation. The results suggest that group attraction is maximized when pre-test expectancy of success coincides with objective task success.

The study failed in its attempt to generalize the partial reinforcement effect to group behavior, however, it did not decisively rule out its existence. Experience gained during the experiment suggested further improvements in experimental design including less restricted subjects, shorter problems, unlimited trials to extinction and controlled motivation.

Microfilm \$2.00; Xerox \$3.00. 58 pages.

### FACTORS RELATED TO THE VOCATIONAL READINESS OF ADOLESCENT BOYS

(L. C. Card No. Mic 59-3098)

Max Dubrow, Ph.D. Columbia University, 1959

This study considered vocational readiness as the individual's quality of preparedness for the vocational situations appropriate to a given stage of development. It investigated the relationship between vocational readiness and certain biosocial, school performance, and interest factors. It was planned within the theoretical and research framework of the Career Pattern Study, a longitudinal study of the vocational development of early adolescent boys.

The subjects were 130 boys, all the ninth-graders attending the Middletown, New York high school. All had participated in four interviews covering their vocational plans, activities, and objectives. Results of tests, questionnaires, and rating scales were also available for each subject.

The vocational readiness scale was developed from content analysis of the interviews by ordering the subjects' statements within four components: (a) Awareness of the need for choice, (b) Awareness of factors in vocational choice, (c) Awareness of contingency factors, (d) Acceptance of responsibility for choice. The scale items were selected for their relevance for the common vocational developmental task of the ninth grade—the choice of high school courses. Items were ordered according to the maturity of the behavior expressed. Maturity determinations were adapted from developmental principles and Ginzberg's theory of vocational choice.

Measures of internal consistency and item analysis of the scale were accepted as evidence of content validity. The behavior relevance of vocational readiness as a psychological construct, and its connection to a theoretical network, were examined by tracing the relationships among vocational readiness, vocational development, and vocational maturity.

The hypotheses tested were the presence of positive relationships between vocational readiness and (1) Age within the same grade, (2) Intelligence, (3) Socioeconomic status of the family, (4) Level of preferred occupation, (5) School grades, (6) School grades as determined by factors other than intelligence, (7) Primary interest pattern on the Strong Vocational Interest Blank (VIB), (8) Interest Maturity scores on the Strong VIB, and (9) Occupational Level scores on the Strong VIB.

Measures of the predictor variables were obtained by reliable instruments. Interviewer difference as a factor in vocational readiness scores was ruled out on the basis of a statistical test. The hypotheses were tested by correlational methods and were sustained if the obtained coefficients of correlation were significant at the .05 level of confidence.

The major findings were low, positive relationships between vocational readiness and factors (2) Intelligence, (3) Socioeconomic status of the family, (4) Level of preferred occupation, (5) School grades, and (6) School grades with intelligence held constant. Relationships between vocational readiness and the interest factors derived from the Strong VIB were not found. The relationship between vocational readiness and chronological age within the same grade was not significant even when the effect of intelligence was controlled.

The positive findings were in accordance with previous related research. The failure to find relationships between vocational readiness and the age and interest variables was explained partly by the inappropriateness of these factors as indices of maturity for an early adolescent group, and the possibility that the vocational readiness scale was measuring a different kind of maturity.

The concept of vocational readiness as a method of diagnosing and assessing vocational behavior was viewed as a possible aid for school guidance workers. Suggestions for future research stemming from this investigation included longitudinal study of early adolescents expressing "no vocational choice" or a deferred choice, further investigation of vocational readiness, and more study of the applicability of Strong VIB interest factors to early adolescents.

Finally, three case studies were presented to illustrate how ninth grade boys could be differentiated according to high, average, and low degrees of vocational readiness.

Microfilm \$2.00; Xerox \$4.80. 93 pages.

SCIENTIFIC MOTION ANALYSIS STUDIES OF MOVEMENT INTERACTION

(L. C. Card No. Mic 59-3255)

Donald LeRoy Hecker, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Karl U. Smith

The purpose of this study has been to investigate the effects of interaction between the components of movement brought about by variations of the internal relation-

ships of a motion pattern. The motion pattern dealt with consisted of performing four dial-setting and four push-button manipulations in a pre-defined sequence. Variations within this pattern of movement were introduced in terms of symmetry or asymmetry and the orderly combining or intermixing of the arrangement of the two forms of manipulation.

Two separate experiments, each using twenty-four subjects were conducted. In the first experiment, measures of the total travel and manipulative times were recorded for eight patterns of motion; four in which each form of manipulation was varied in terms of symmetry, and four in which a combination of the forms of manipulation was varied in terms of both symmetry or asymmetry and orderly combining or intermixing. In the second experiment measures of travel times to the right and to the left, and manipulative times for left and right sides of the motion pattern, were recorded for only the patterns varied in terms of both symmetry and combining or intermixing of forms of manipulation. Measures were taken daily over a seven day period in the first experiment and a four day period in the second experiment. High precision methods of electronic motion analysis were used to obtain the time scores. The main findings were:

- 1. Intermixing the forms of manipulation within a pattern of movement lead to substantial increases in the times for both the travel and manipulative components of that movement.
- 2. Asymmetry in the arrangement of forms of manipulation lead to relatively little increase in the travel and manipulative times for that movement.
- 3. The decrement in total duration of a pattern of movement due to both asymmetry and intermixing of forms of manipulation was less than that predicted by an additive combination of separate effects of these two variations.
- 4. Differential effects were noted in the two separate travel movements as a result of the intermixing of forms of manipulation. The travel time for movement to the right decreased, whereas the travel time for movement to the left increased.
- 5. The differential effects noted in the two travel movements were modified by asymmetry. As compared to the symmetrical arrangement, under asymmetry the travel time for movement to the right decreased to a greater extent, the time for hand movement to the left increased to a less extent.
- 6. Changes in the form of manipulation at the ends of a travel distance of fixed length lead to a marked increase in travel time for that distance.

The results were discussed in terms of their relevance to the study of human motion and to the applied fields of time study and motion economy. The main conclusions were that a large part of the admitted error in industrial predetermined time systems is tracable to interactive effects due to variations in the internal relationships of motion patterns. Complexity of a task, when defined in terms of the uniformity of travel elements within a task, has little effect upon overall efficiency. It was suggested that the differential effects noted in the two travel times were reflections of compensatory changes due to the subject's overall pacing of the tasks.

Microfilm \$2.00; Xerox \$5.80. 119 pages.

GATING: THE APPLICATION OF A PERCEPTUAL THEORY TO THE ISSUE OF DIAGNOSIS IN PSYCHOTHERAPY

(L. C. Card No. Mic 59-2639)

Robert Bernard Levinson, Ph.D. Michigan State University, 1958

Gating is a process introduced by Bruner (1) as part of a perceptual theory. It is a mechanism which permits the passage of certain stimuli in the environment (those in accord with an individual's category system) and blocks passage of other stimuli (not in accord with the category system). A category system may be conceived of as a network of sets, or personal constructs, which evolve from a process of learning how to isolate, weigh, and use critical attributes or cues, and which is markedly influ-

enced by individual expectations and needs.

The process of gating has direct implications concerning the use of formal diagnostic procedures in psychotherapy. The commonly accepted view -- "diagnostic" position -holds that pre-therapy plans (based on diagnostic techniques) enhance a therapist's understanding and, thereby, increase his effectiveness with a client. Adherents of an "a-diagnostic" viewpoint, however, suggest that pre-therapy formulations may blunt the therapist's understanding of his client. That is, the operation of a gating mechanism could result in a selective screening out of certain of the stimuli present in therapeutic interviews--namely, those cues not in accord with the pre-therapy schema--while, at the same time, other cues (more in accord with the pre-therapy plan) may be over-evaluated.

This study concerned itself with the following general

proposition:

the type of preconceived categorization system with which one approaches events will affect the sensitivity to nuances in those events

The proposition was investigated through two, more specific, hypotheses.

#### Hypothesis 1:

the sensitivity of an individual to nuances of a situation will be diminished if he approaches that situation with a preconceived categorization system

### Hypothesis 2:

the sensitivity of one individual for another person will increase as the degree of congruence between the categorization systems of the two individuals increases

Using a Q-methodology design, 32 clinical psychologists, (in four groups of eight each) after doing a self-sort, attempted to predict a client's self-concept (as revealed by Q-sorts) on the basis of diagnostic and interview material. Each judge made two predictions. The dependent variables were the accuracy scores--the degree to which the predictions approximated the client's actual sortings. The independent variable was the sequence in which the stimulus material was presented. Four sequences were employed: (i) Interview (I") material before Diagnostic (D) material; (ii) D I"; (iii) I' I"; (iv) I" I"--conditions (iii) and (iv) represent controls; I' and I" being, respectively, the 11th and 13th tape recorded therapy sessions.

Using an analysis of variance technique, the results obtained indicate:

> Diagnostic material does not markedly enhance nor significantly decrease the sensitivity of a Judge to Interview material; and, similarly, for the effect of Interview material on Diagnostic material

> Although the presentation sequence of the stimulus material does not significantly affect sensitivity, making two predictions, particularly if based on widely differing types of material, results in significantly less accuracy for the second prediction

Support was found for the validity of Hypothesis 1

The validity of Hypothesis 2 remains in question; the results were in the anticipated direction but did not reach the level of statistical significance

The general proposition underlying this study was, in the main, supported by the findings

The limitations of this investigation, as well as its implications for clinical practice and future research, were discussed.

### REFERENCES

1. Bruner, J. S. "On perceptual readiness" Psych. Rev. 1957 64:123-152 Microfilm \$2.00; Xerox \$6.20. 128 pages.

### THE CONSTRUCT VALIDATION OF A REPUTATION TEST

(L. C. Card No. Mic 59-3496)

Wilbert Wallace Lewis, Jr., Ed.D. George Peabody College for Teachers, 1959

Major Professor: Nicholas Hobbs

The purpose of the study was to construct a group test to be used in screening for emotional disturbance in an elementary school population. The method employed in test construction was a peer nomination technique, a variant of standard sociometric procedure. The three factors of social acceptability, aggressive maladjustment, and social isolation, identified by Mitchell's analysis of reputation data, served as a starting point in developing the three constructs measured by the Reputation Test.

The development and construct validation procedures of the Reputation Test were carried out in six steps: (a) administration of an initial set of items and analysis of their intercorrelation, (b) the selection and administration of a revised set of items, (c) a reliability study of the three group scores on the revised form, (d) a study of parent ratings given to children who had received high scores on the Reputation Test, (e) a study of school achievement of high-scoring children, and (f) case studies of individual high-scoring children.

The items used in the Reputation Test were derived from correlational analysis of 12 brief behavioral descriptions submitted to third-grade subjects with instructions

to identify members of the class who best fit each description. The original item analysis resulted in a revised form consisting of three items describing each of the three constructs. On the revised form of the test, each group of three items proved to be internally consistent, to have significant positive correlation within the group of three items, and to have no correlation with items representing the other two constructs. The addition of a Best friend item completed the revised form of the Reputation Test.

The test-retest reliabilities of the three groups of items were estimated as .98 for social acceptability, .82 for aggressive maladjustment, and .72 for social isola-

tion.

Scores on the Reputation Test were used as a means of selecting high-scoring children who represented extreme degrees of each of the three kinds of behavior. Three separate studies of group differences were made of these high scoring children.

All children used in the studies were third-grade pupils in the Memphis Public Schools.

For the first study, parent ratings were obtained for a sample of 30 high-scoring children in order to compare peer perceptions and parent perceptions of the characteristic roles of the same children. The parent ratings showed a high degree of congruence with peer nominations. If a child was described by his classmates as socially acceptable, then his parents were likely to describe him in the same way. The same was true of the children described as aggressively maladjusted and socially isolated.

The second study of group differences involved a comparison of school achievement of children who made unusually high scores on one of the three constructs measured by the Reputation Test. To control for intelligence and sex, six groups of children in the IQ range 90-110 were selected, fifteen boys and fifteen girls as representative of each construct. Although there was no difference among the means of the six groups on intelligence test scores, both boys' and girls' social acceptability groups made better scores on standardized reading and arithmetic tests than the aggressive maladjustment or social isolation groups.

The third study of group differences made use of six brief case studies to determine whether expected differences would be found between individuals who had made high scores on one of the three constructs of the Reputation Test. In general, the case history findings, combining parents' and teachers' comments with psychological test and interview material, confirmed the expectations held

for individual high-scoring children.

A summary evaluation of the Reputation Test as a screening instrument for emotionally disturbed children is that (a) the test is suitable for group administration to elementary school students, (b) the test quantifies significant and relatively stable patterns of behavior, and (c) the patterns so identified are related in predictable ways to parents' description of their children, to achievement in school, and to case study findings on individual children.

Microfilm \$2.00; Xerox \$5.40. 109 pages.

### AN EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF TRAINING UPON CREATIVITY

(L. C. Card No. Mic 59-3046)

Patrick James Nicholson, III, Ph.D. University of Houston, 1959

This experiment was designed to determine the effects of training 32 subjects (psychology students at the University of Houston) in creativity, using six varied training methods during a regularly-scheduled 45-hour course of instruction.

Training methods included: (1) lecture and discussion of the main points in Osborn's Applied Imagination and accompanying Teacher's Guide; (2) the "other-world" technique of Arnold, as adapted by Gerry, De Veau, and Chorness; (3) lecture and discussion of "traditional" approaches to problem-solving, as exemplified by Dewey and Wallas; (4) actual time in brainstorming, apart from related Osborn training; (5) training with locally-produced materials such as an adaptation of Guilford's Associations Test; and (6) miscellaneous procedures such as Maltzman's "word association in depth" technique. Subjects also looked upon the various tests administered as predictor and criterion measures as constituting training.

Experimental subjects were administered the following predictor measures before training began: Raven's Progressive Matrices, the Rokeach Dogmatism Scale, True's Creativity Scale, Luchins' Water Jar Test, Sheer's Self-Concept Test, either the I-V or VI-X alternate form of Guilford's Consequences Test, and Thurstone's Word Fluency Test. Experimental subjects also participated in a five-minute brainstorming session which was tape-recorded for later analysis and use as a predictor measure.

The principal criterion measure was Guilford's Consequences Test, alternate forms of which were administered to experimental subjects and to 75 controls after the experimental group had completed training. Experimental subjects also participated in a second five-minute brainstorming session which was tape-recorded and then analyzed for number of ideas as a further criterion measure.

Major findings were as follows:

- (1) The experimental group improved significantly, when compared to the controls, in the production of remote or uncommon ideas.
- (2) There was also an increase in obvious or common idea, but the increment was less in magnitude than the gain in remote ideas.
- (3) There was a significant relationship between four of the five factors in the Sheer Self-Concept Test and improvement in the production of obvious ideas.
- (4) No significant relationship was determined between attitude toward creativity and performance after training, or between rigidity and performance after training.

Results of the experiment are interpreted to suggest that training by varied methods can be used to bring about a significant improvement in the production of remote or uncommon ideas. This gain in the quality of ideas elicited, however, is not paralleled by a similar gain in quantity of ideas.

The findings also suggest that the Sheer Self-Concept Test can be used to differentiate between subjects in predicting success in training in creativity.

Microfilm \$2.00; Xerox \$5.80. 116 pages.

THE EVALUATION OF SOME NEW
THREE-DIMENSIONAL SPATIAL VISUALIZATION
TEST ITEMS AS PREDICTORS OF SUCCESS IN
ART, ARCHITECTURE, AND ENGINEERING DRAWING

(L. C. Card No. Mic 59-3035)

Jack T. Waggoner, Ph.D. University of Houston, 1959

The general purpose of this study was to construct new types of three-dimensional spatial test items and to make a preliminary evaluation of these items as predictors of success in courses in art, architecture, and engineering drawing.

Three types of items were constructed and prepared in a test booklet entitled, A Test of Spatial Visualization. The test booklet included 20 items of the "Block Building" type, 20 items of the "Object Visualization" type, and 30 items of the "Light and Shadows" type.

The test was then administered to 361 students pursuing training at the University of Houston during the Fall Semester, 1958-59, and to 70 prospective entering freshmen students for the Spring Semester, 1959.

Evaluation of the test consisted of investigations of the total test, the individual items, and the three major parts. A reliability coefficient was obtained by the split-halves method and corrected by use of the Spearman-Brown prophecy formula. The corrected coefficient of .90 is well within the acceptable ranges of reliability coefficients for tests of this type.

In the evaluation of the test items as a total group, two types of criterion measures were used: (a) mid-semester ratings and (b) final grades in various "drawing" courses in art, architecture and engineering drawing.

Contingency coefficients, used as validity coefficients, were obtained between groupings of the criterion measures and performances on the total group of test items. "Moderate" to "substantial" relationships were observed between the total test scores and mid-semester ratings in various criterion "drawing" courses. The relationships obtained between final grades in these courses and total test performance were "moderate" and less marked than those obtained for the mid-semester ratings.

From the analysis of the individual items, four of the seventy items were found to be void because of constructional or drawing errors. For the remaining sixty-six items, significances of the differences in the responses of the highest 27% and the lowest 27% on the total test score were tested. Fifty of these were found to have differences that were statistically significant at the .001 level, six at the .01 level, six at the .05 level, and in four the differences were not significant at the .05 level. Flanagan product-moment coefficients were also obtained for these groupings with all, except the four items whose differences were not significant at the .05 level, having coefficients that indicated "outstandingly valid" items.

The over-all percentage of correct responses to the sixty-six items evaluated was seventy-two for a general college population group, and fifty-eight for the prospective entering freshmen group.

The analysis of the intercorrelations of the part-scores and mid-semester ratings in engineering drawing indicated that Part III items possessed the strongest degree of relationship with the mid-semester ratings. Part I and Part II items also seemed to contribute to the relationship of

the total score with these ratings to an extent such that their inclusion in any revision of this test would seem warranted.

Microfilm \$2.00; Xerox \$5.80. 117 pages.

# THE HEREDITARY DETERMINATION OF INDIVIDUAL DIFFERENCES IN GEOTAXIS IN A POPULATION OF DROSOPHILA MELANOGASTER

(L. C. Card No. Mic 59-2871)

Jane M. Weiss, Ph.D. Columbia University, 1959

An experiment was conducted investigating individual differences in geotaxis, the response to gravity, in a population of <u>Drosophila melanogaster</u>. The problem was to determine to what extent individual differences are under the control of heredity. The technique of selective breeding was used for this purpose.

Geotaxis was measured in the multiple unit classification maze which provides for the reliable measurement of individual subjects and at the same time for the observation of large numbers of subjects. The maze consists of 15 mass screenings. Subjects run through the maze obtain scores ranging from 0-15, indicating the number of times a negative response is made to the force of gravity.

Flies were selected for breeding on the basis of their geotactic scores. Those with extremely low scores were bred to develop the Low Geo strain and those with extremely high scores were bred to develop the High Geo strain. This procedure was continued for 20 generations, the strains being maintained separately after their initial separation. At the 11th and again at the 15th generation the lines were crossed to yield information concerning the genetic mechanisms involved.

The results clearly indicated that individual differences in geotaxis in <u>Drosophila melanogaster</u>, as measured in this experiment, are influenced by heredity. A response to selection was obtained in both directions and the strains were sharply differentiated at the 20th generation. The progress of the two lines was somewhat different and there are indications that the genetic systems of the High and Low Geo lines differ. The results of the crosses between the strains are consistent with the hypothesis that many genetic factors are involved.

The data of previous experiments on selection for behavioral traits are reviewed and compared with the present findings.

Principles and techniques of genetics are discussed. It is suggested that by using the concepts of population genetics and following the experimental methods employed, analyses of the genetic bases of behavioral traits may be more profitably undertaken.

Microfilm \$2.00; Xerox \$5.20. 104 pages.

#### PSYCHOLOGY, CLINICAL

PREDICTING RESPONSE TO GROUP PSYCHOTHERAPY

(L. C. Card No. Mic 59-3354)

Alice Virginia Anderson, Ph.D. The University of Oklahoma, 1959

Major Professor: Richard G. Cannicott

The widespread use of group psychotherapy in mental hospitals and the lack of research on factors predictive of patients' response to this treatment were the bases of the present study which was designed to evaluate the usefulness of several measures as predictors of patients' response to group psychotherapy. The measures selected for evaluation as predictors were clinical judgments of psychiatrists, five special scales of the Minnesota Multiphasic Personality Inventory (MMPI)—the Barron Ego-Strength Scale, the Winne Neuroticism Scale, the Taylor Manifest Anxiety Scale, the Welch Anxiety Index, and the Welch Internalization Ratio—and a Projection Scale.

The special MMPI scales were chosen for study as they had been found related to response to individual psychotherapy by previous investigators. The Projection Scale was devised by the experimenter as a measure of self-acceptance, a factor theoretically related to ability

to make use of psychotherapy.

Forty-five patients, 20 females and 25 males, ranging in age from 17 to 63 years with a median age of 35, predominantly diagnosed as psychotic, were selected from the intensive treatment wards of Central State Griffin Memorial Hospital as subjects for the experiment.

Prior to group psychotherapy each subject was rated by his ward psychiatrist on a seven-point graphic rating scale as to his predicted response to group psychotherapy, and was administered the MMPI and the Projection Scale. The Projection Scale consisted of an index derived from the subject's ratings of pictures of people, ratings of himself, and ratings of himself as he would like to be, on a list of 16 selected traits. Subjects were rated twice by their respective psychotherapists -- at one week and at the end of three months -- on the Palo Alto Group Psychotherapy Scale, a scale measuring the level of the subject's interpersonal relationships. The difference between the two scores was the criterion score for response to group psychotherapy. The Pearsonian r statistic was employed to test the relationship between the selected prediction measures and the Psychotherapy change scores.

The results of the experiment led to the following conclusions:

1. Although significant response to group psychotherapy occurred, interpreted as an improvement in the level of interpersonal relationships, this response was not found to be predictable for psychotic patients on the basis of any of the seven selected measures.

2. While of questionable predictive value, psychiatrists' judgments tended to be more reliable for group psychotherapy response prediction when based on an enumeration of patient characteristics than when based on a single global judgment.

The Palo Alto Scale appears to be a useful tool for evaluating mental hospital patients' level of interpersonal

relationships.

4. Combined usage of nineteen items of the Palo Alto Scale was suggested for further research as a possible predictive scale for group psychotherapy response.

Microfilm \$2.00; Xerox \$6.00. 123 pages.

### CHILDHOOD AND TEEN-AGE MEMORIES IN MENTALLY ILL AND NORMAL GROUPS

(L. C. Card No. Mic 59-3093)

June Boyer Charry, Ph.D. Columbia University, 1959

In recent years memory has been increasingly recognized as a dynamic process, influenced by personality and emotional factors. Laboratory tasks have usually been used to measure the relationship between individual differences, emotional influence, and recall. The present study was designed to explore the memory process through the actual life events reported by individuals with differing levels of life adjustment. In general it was postulated that schizophrenic and normal individuals would reveal differences in the affective tone of life experinces reported.

The subjects were 40 hospitalized schizophrenics and 40 normal individuals (20 males and 20 females in each group), whose ages ranged from 21 to 38, equated for age, sex, education, and socioeconomic background. Each subject was interviewed to elicit childhood and teen-age memories. They were asked specific, open-end questions concerning their experiences up to the age of 5, between the ages of 5 to 12, and between the ages of 12 to 20. The questions were designed to cover: (a) parent-child relationships, (b) relationships with friends, (c) sexual development, (d) sibling relationships, (e) school adjustment, and (f) self-concept. Three judges independently judged each memory as unpleasant (fear, guilt, blame, unhappiness, feelings of failure, personal inadequacy), pleasant (joy, satisfaction, happiness), or neutral (statement of fact). Only the memories on which all three judges agreed were used for comparison in the statistical analysis.

The results were:

(1) Significantly more schizophrenics reported a lower proportion of pleasant memories than normal subjects, but there were no differences in unpleasant recall.

(2) More schizophrenics tended to have less pleasant memories of their 12 to 20 years than of their 5 to 12 years, while there were no differences in the affective tone of their memories prior to age 12.

(3) Significantly more normal individuals gave an increasingly higher percentage of pleasant memories with each successive age range.

(4) Schizophrenics recalled significantly fewer experiences than normal individuals.

Additional Findings:

(1) Significantly more schizophrenics reported a smaller proportion of pleasant memories than normal persons only in experiences of the 12 to 20 years. There were no differences in unpleasant memories through the three age ranges.

(2) Within the schizophrenic group, neither sex nor education was associated with the affect-memory variable. In the normal group, higher education was associated with more pleasant and fewer unpleasant memories. Females

had more unpleasant memories than males and also comprised most of the lower educational group.

(3) Analysis of the six question categories revealed differences only in the self-concept area. More schizophrenics than normal subjects had a higher proportion of unpleasant memories of self, specific to the 12 to 20 age range.

Conclusions:

(1) The dearth of pleasant memories among the schizophrenics, not the abundance of unpleasant memories, mark them from the normal persons.

(2) A schizophrenics most recent experiences are recalled more unpleasantly than earlier events.

(3) Schizophrenics verbalize fewer memories than normal subjects, either because they recall less or report fewer.

Additional findings suggest that schizophrenic and normal individuals do not view their lives differently, in terms of the affective tone of their memories, until the age of 12. Normal persons have more pleasant recall of experiences beyond the age of 12 than do schizophrenics. Schizophrenics exceed normal individuals in unpleasant memories from the ages 12 to 20 concerning their self-concept.

Microfilm \$2.00; Xerox \$4.00. 71 pages.

### CONNOTATIVE MEANING AS A VARIABLE IN MARITAL SUCCESS AND DISCORD

(L. C. Card No. Mic 59-3112)

Myer Katz, Ph.D. Columbia University, 1959

The present study investigated the relationship between extent of discrepancy between spouses in the connotative meanings they ascribe to concepts and marital happiness or discord. Based upon the assumption that marital adjustment is related to the degree of similarity between the spouses, the study proposed the general hypothesis that troubled married partners are more discrepant in their semantic structures than are untroubled marital partners. Four specific research hypotheses were proposed. The subjects used in the study were a group of twenty couples seeking counseling because of unhappiness in marriage and a comparable group of twenty happily married couples.

The two groups of couples were highly comparable with respect to age, education, length of marriage, social class and intelligence. At the same time there were highly significant differences between the husbands and between the wives in the two groups with respect to the status of their marital relationship.

A form of the semantic differential, a combination of association and scaling procedures designed to give an objective measure of the connotative meaning of concepts, was constructed. The two groups of couples were asked to judge twenty concepts (ten concepts of relevance and ten concepts of no relevance to marriage) by means of the semantic differential scales.

Husband and wives were separated while completing the series of judgments to avoid any possible collaboration. The test forms were numbered in duplicate, maintaining subject anonymity while making possible the subsequent identification of the two members of each couple. Measures were then obtained of the discrepancies between spouses, of both groups, in their judgments of concepts.

The four research hypotheses were confirmed at high levels of significance when tested by upper tailed Mann Whitney U tests.

The two groups of marital partners differ in their meanings of marriage related concepts. Disagreement between spouses on concepts unrelated to marriage bears no relationship to the troubled or untroubled status of the marriage. However, greater semantic harmony between couples on marriage-related issues is associated with marital happiness.

The results of the study confirm the general hypothesis of greater semantic similarity between happily married couples as compared with unhappily married couples and also lend support to the viewpoint that meaning is an important variable in human interaction. The findings are in keeping with previous research highlighting psychological similarity of marital partners as a function of marital happiness.

The present study demonstrated the usefulness and appropriateness of the semantic differential as an instrument in research on marriage and also served to validate the importance to marriage of those concepts classed as "marriage-related."

The findings of the present study suggest that the semantic differential may be of diagnostic, evaluative and research import to marriage counseling practitioners.

Microfilm \$2.00; Xerox \$4.80. 91 pages.

### EFFECTS OF CHLORPROMAZINE AND PROMAZINE ON TESTS OF PERSEVERATION

(L. C. Card No. Mic 59-3115)

Eric Levita, Ph.D. Columbia University, 1959

This study dealt with the effect of tranquilizing drugs upon changes of behavior. Specifically, the action of chlor-promazine and promazine on perseveration was investigated by means of a double-blind procedure.

The subjects for the experiment were 34 English-speaking outpatients with a history of mental disease of one year or more who had been referred to the Psychopharmacologic Clinic of the Kings County Hospital at New York City. All patients had been diagnosed as undifferentiated schizophrenics on the basis of psychiatric interviews. Subjects, unaware of any experimentation, were randomly assigned to three groups. One group received chlorpromazine, another was treated with promazine, and still another received a placebo. The oral administration of the drugs ranged from 50 to 400 mg. daily.

A battery of tests of perseveration was given to the subjects at the beginning and the end of a period of three months. Difference scores in perseveration were derived from data collected before and after the respective treatment with chlorpromazine, promazine, and a placebo. These difference scores were used as a measure of change in perseveration. Postexperimental scores for perseveration were obtained from the data and were also assumed to

reflect variations in perseveration related to the differential effect of the medication used.

The following hypotheses were not confirmed: (1) A difference exists between changes in perseveration preceding and following the respective administration of chlor-promazine, promazine, and a placebo; (2) The change in perseveration related to the administration of chlorpromazine is greater than the corresponding change related to the administration of promazine; (3) The change in perseveration related to the administration of chlorpromazine is greater than the corresponding change related to the administration of a placebo; and (4) There is a difference in the variations of perseveration following the respective administration of chlorpromazine, promazine, and a placebo.

The findings were discussed in terms of motor activities, and Pavlov's inhibition. It was suggested that the social stimulus value of a medication may well determine its effectiveness. It was also suggested that variations in the dosage of tranquilizers may warrant further investigation of the effects of ataractics upon perseveration.

It was concluded that: (a) the administration of chlorpromazine and promazine does not adversely affect the presence or absence of perseveration as defined in the present study; (b) the administration of chlorpromazine and promazine has no influence upon perseveration beyond that inherent in treatment with a placebo.

Microfilm \$2.00; Xerox \$3.60. 65 pages.

## AN APPLICATION OF THE EDWARDS PERSONAL PREFERENCE SCHEDULE TO PROBLEMS IN PSYCHOPATHOLOGY

(L. C. Card No. Mic 59-3336)

James Robert Milam, Ph.D. University of Washington, 1959

Chairman: C. R. Strother

The purpose of the study was to explore the applicability of the EPPS to problems in the field of psychopathology. The EPPS was administered to three groups of hospitalized patients; a group of paranoid schizophrenic patients, a group of ulcer patients, and a "control" group of patients with mixed psychiatric symptoms, exclusive of paranoid and ulcer symptoms. There were 40 male patients in each group. To test the ability of the EPPS to discriminate between each pair of groups, three different types of statistical techniques were employed. These were a non-parametric method, a configural method, and the conventional multiple regression method. Means and standard deviations for all EPPS scales were also computed.

Two significant mean differences were found between each pair of patient groups. The ulcer patients scored lower on n-Achievement and higher on n-Change than the mixed group. Paranoid patients scored higher on both n-Deference and n-Intraception than the mixed group. Between the paranoid and ulcer groups, paranoid patients scored higher than ulcer patients on the n-Intraception scale, and ulcer patients scored higher on n-Change than the paranoid patients.

The multiple regression method proved to be the most

effective in the discrimination between each pair of patient groups. 65% of the paranoid and mixed patients were correctly discriminated, 68.8% of the ulcer and mixed patients were correctly discriminated, and 92.5% of the paranoid and ulcer patients were correctly discriminated by the multiple regression method. It was concluded that the EPPS is sensitive to significant dimensions of psychopathology, and that it is a potentially useful research instrument in this field.

Microfilm \$2.00; Xerox \$3.00. 57 pages.

### THE PSYCHOLOGICAL EFFECTS OF PROMAZINE ON CHRONIC PSYCHIATRIC PATIENTS

(L. C. Card No. Mic 59-3132)

Edward Stanton Sulzer, Ph.D. Columbia University, 1959

Since the development of the tranquilizing drugs (ataractics), a considerable amount of literature has been devoted to reports of the purported efficacy of the drugs. However, little in the way of long-term controlled research has been published, so that a healthy skepticism regarding the psychological and personality changes wrought by these new drugs has developed among those who have the responsibility of recommending and giving treatment to hospitalized psychotics.

A survey of the available literature revealed that the following hypotheses were frequently advanced to describe behavioral and personality changes in patients. These were offered as the hypotheses for this research. Previous studies have demonstrated that the MMPI yields measurable correlates of behavioral and personality changes in patients. Therefore, the hypotheses were framed as both general statements and specific predictions of concomitant MMPI variables that should be altered by the drugs.

 Promazine reduces tension and anxiety level, as measured by lower A and Pt scale scores.

2. Promazine reduces phobic, obsessive and bizarre thinking and behavior, as measured by lower Pt, Sc, and Pa scale scores.

3. Promazine reduces hyperactivity, as measured by a lower Ma scale score.

4. Promazine reduces depressive ruminations in patients revealing pathological depression but who were not considered manic depressives, as measured by a lower D scale score in patients with initially high D, i.e. over

5. Promazine reduces over-sensitivity and delusional thinking in patients revealing strong paranoid trends, as measured by a lower Pa scale score for patients with initially high Pa i.e. over 70.

6. Promazine reduces distractability and creates a situation in which the patient is more able to attend to the task at hand, as measured by a lower F scale score.

7. Ego defenses, particularly repression and suppression, are utilized more effectively with promazine, as measured by higher K and Es scale scores.

8. Promazine creates a more stabilized pattern of adjustment and decreases abnormal deviation in thinking and behavior, as measured by fewer scale scores over 70.

The subjects for this study were 41 young male chronic

schizophrenics. The drug used was promazine hydrochloride and the daily dosage was 400 milligrams. Twentynine of the patients were entered in group therapy.

A placebo that could not be differentiated from the drug capsule was employed and neither patients, medicators, nor investigator was aware of the type of capsule being ingested by a particular patient during the main body of the study. Each patient yielded at least one MMPI protocol while under placebo medication prior to the drug, one protocol under the drug and at least one protocol while under placebo medication following the drug period.

The t test was employed to determine differences between drug and placebo mean scores. At at the .05 level was required for statistical significance. Hypotheses 1, 2, 3, 6, and 7 were not substantiated, as the drug scores on the A, Pt, Sc, Pa, Ma, F, K, and Es scales were not significantly different from the placebo mean scores either for the sample as a whole or for any group of patients. Hypothesis 8 was not supported, as only one scale showed a change for the entire sample and that in the opposite direction of what had been predicted. On no scales including the other usual validity and clinical scales of the MMPI were significant differences obtained between drug periods and placebo periods.

It was concluded that the findings gave no evidence that promazine was effective in altering the behavior of the patients as measured by their MMPI performance. The need for further research regarding the effects of tranquilizers was emphasized.

Microfilm \$2.00; Xerox \$3.60. 62 pages.

### AUDITORY PERCEPTION OF EMOTION BY SCHIZOPHRENIC AND NORMAL PERSONS

(L. C. Card No. Mic 59-3136)

John le Baron Turner, Ph.D. Columbia University, 1959

In the hope of contributing to understanding of schizophrenic person perception, a test was constructed to measure ability to identify speakers' emotions expressed in speech sounds apart from sense or content, and was given to a group of thirty non-paranoid schizophrenics, a group of thirty paranoid schizophrenics, and a group of thirty psychiatrically normal control subjects. A parallel test of identical formal structure but requiring identification of a speaker's age and sex was given to the same subjects in order to correct for any irrelevant factors which might affect schizophrenics' scores on the first instrument. It was hypothesized that schizophrenics--paranoids and non-paranoids combined--would be inferior to nonschizophrenics in ability to recognize emotions in speech, that paranoids would be superior to non-paranoid schizophrenics, and that errors of paranoids would more often than those of others consist in projecting--i.e., erroneously attributing--anger. The performances of the three groups were studied both as to accuracy of performance on the two instruments and as to patterning of errors on the emotion-judging test. Analyses were also made of differences between patients with and without hospital privileges, and of correlations of both instruments with duration of hospitalization, age, and amount of education.

The principal findings were as follows:

1. Ability to identify emotions expressed in speech sounds varies among individuals and can be measured.

2. Schizophrenics are more variable than non-schizophrenics in the above ability, and on the average they are inferior. The higher average ability of the non-schizophrenics is due to a more compact distribution which does not extend as low but which also does not extend appreciably higher than that of the schizophrenics.

3. Paranoid schizophrenics do not, on the average, differ significantly from other schizophrenics.

4. No evidence of projection of hostility by paranoids nor of other kinds of distorted perception could be found in the patterning of their errors as compared with those of other subjects.

5. Patients with hospital privileges identify emotions in speech sounds more accurately than those on locked wards, but the difference is entirely due to differences within the paranoid group.

6. Among non-schizophrenic persons ability to recognize emotions in speech sounds correlates positively with education and negatively with age.

7. The differences reported in ability to recognize emotions in speech sounds cannot be attributed to differences in ability to handle the formal requirements of the test situation. They might be to an unknown extent due to (a) differences in the accuracy with which subjects reported what they actually perceived, or (b) differences in reaction to a task which certain subjects felt little confidence in their ability to handle adequately.

Microfilm \$2.00; Xerox \$4.00. 72 pages.

# THE EFFECTS OF THREE POST-ACQUISITION . PROCEDURES ON A VERBAL AVOIDANCE RESPONSE

PERFERENCE SOMEDVER TO PROBLEMS

(L. C. Card No. Mic 59-3138)

Loretta Berkowitz Walder, Ph.D. Columbia University, 1959

This study was concerned with the effects of three post-acquisition procedures on a verbal avoidance response. It was hypothesized that response decrement occurs when punishment of nonavoidant responses is discontinued when the conditioned avoidance response is no longer permitted to avoid punishment. It was also hypothesized that receiving the information that punishment will be discontinued, or that receiving punishment for emitting the avoidance response itself yields more rapid response decline than a conventional extinction procedure in which all punishment is discontinued following conditioning.

Seventy Teachers College students volunteered as Ss for this experiment. Three groups of 20 Ss were conditioned to respond to a list of random numbers by choosing one of three specified colors for each number. Two colors were randomly punished by the examiner's statement "wrong" while the third color which was selected as the avoidance response received no negative reinforcement. The avoidance response was conditioned to a criterion which was established on the basis of a control group. After the conditioning criterion was reached, the following

post-acquisition procedures were employed:

1. punishment of <u>blue</u> and <u>yellow</u> was discontinued and 200 extinction trials were administered.

2. So informed that punishment was discontinued were exposed to 200 extinction trials during which punishment of blue and yellow was discontinued.

3. 200 trials were administered during which all responses received intermittent punishment, followed by 100 trials during which all punishment was discontinued.

No significant differences existed between operant level, number of conditioning trials, and rate of responding at the end of conditioning for the three experimental groups. Discontinuation of punishment of blue and yellow served to decrease conditioned orange responding but did not effect a return to operant level. Intermittent punishment of the avoidance response itself resulted in the response returning to operant level. Informing Ss that punishment is discontinued, or punishing the avoidance response, did not yield more rapid response decrement than simply discontinuing punishment of blue and yellow. Peripheral aspects of the punishment treatment were explored.

The present experiment was an attempt to extend concepts and techniques of learning theory to the area of verbal avoidance behavior. The successful conditioning was attributed to limiting responses. It was suggested that the divergence between this study's conclusion and previous research on the effect of information was due to the mild nature of the aversive stimulus used. The failure to obtain differences in response rate between the Punished Group and the Uninstructed Group was discussed in terms of the adequacy of the measures employed. The failure of the orange response to recover strength after punishment was terminated was discussed in relation to the length of the measurement period. Suggestions were made for future research in the areas of avoidance extinction, and the relationship of personality variables to the degree to which systems correspond to reality.

Microfilm \$2.00; Xerox \$3.00. 48 pages.

# A STUDY OF MAGICAL THINKING AND OTHER PSYCHOLOGICAL PROCESSES ASSOCIATED WITH BEHAVIORAL ADJUSTMENT TO BLINDNESS

(L. C. Card No. Mic 59-1990)

Stanley P. Zarlock, Ph.D. University of Buffalo, 1959

This research was designed to investigate the psychological processes related to the problem of behavioral adjustment to blindness. Levels of adjustment to blindness were measured by the Behavioral Rating Scale. These levels were then compared with psychological variables measured by a set of psychometric instruments.

From somatopsychology, a theory proposed by Barker and his associates, as well as from the contributions of Freud, Piaget, and Odier, two sets of hypotheses were formulated about the psychological behavior of blind individuals. The first set of hypotheses served as a measure of validity for the Behavioral Rating Scale and dealt with the concepts of personal adaptibility, manifest anxiety, and attitudes towards blindness. A prediction was made that these psychological variables would correlate sig-

nificantly with behavioral adjustment to blindness as measured by the Behavioral Rating Scale. The second set of hypotheses was less obviously associated with behavioral adjustment to blindness and dealt with the concepts of magical thinking and anti-democratic personality. It was predicted that the use of magical logic towards the restoration of health and certain features of the anti-democratic personality would be inversely related to an adequate adjustment to blindness as measured by the Behavioral Rating Scale.

Fifty-two totally blind male subjects were assigned scores on the Behavioral Rating Scale. This independent variable indicated the amount of adjustment made in ten problem areas: employment, travel, indoor orientation, socialization, communication, recreation, eating problems, dressing problems, personal business problems, and physical hygiene.

After each blind subject was rated for behavioral adjustment to blindness, a set of psychometric scales was administered to each subject. Scores obtained on these scales served as the dependent variables in this investigation. The psychological tests used to measure the dependent variables were: The Barron Ego Strength Scale, the Taylor Manifest Anxiety Scale, the Fitting Scale for attitudes towards blindness, an attitude scale towards miraculous cures in medicine, an attitude scale towards miraculous cures in religion, and the California F Scale. A comparison of scores on these psychometric instruments made it possible to confirm or refute the hypotheses mentioned above.

Twenty-five physically normal subjects were used as a control group. These individuals were matched for age, education, socio-economic background, and religious affiliation with 25 of the better adjusted blind subjects.

The results revealed that behavioral adjustment to blindness is largely determined by ego strength, manifest anxiety, and attitudes towards blindness. The research data also offer support for the validity of the behavioral rating scale. The scale appears to be an effective instrument for measuring levels of behavioral adjustment as well as an effective device for making predictions about the psychological behavior of blind individuals.

The results also revealed a significant relationship between behavioral adjustment to blindness and magical thinking. Non-adjusted blind subjects held more extreme and more positive attitudes towards the efficacy of medicine and religion to restore health than subjects who were well adjusted. Similarly, a significant relationship existed between behavioral adjustment and "anti-democratic personality". Poorly adjusted blind subjects were more dependent on authority and were less self-confident than well adjusted blind subjects.

Intelligence was an important experimental variable in the measures of attitudes towards blindness and attitudes towards medical cures. When the mean scores for two groups of blind subjects were adjusted for intelligence by means of co-variance, the mean difference was not significant at the .05 level. However, the variable of intelligence did not change the level or significance of the remaining psychological measures.

Finally, the attitudes, perceptions, and psychological characteristics of well adjusted blind subjects were similar to those of physically normal individuals. These two groups did not differ on measures of ego strength, manifest anxiety, attitudes towards miraculous cures, and attitudes towards authority. Microfilm \$2.00; Xerox \$7.00. 146 pages.

PSYCHOLOGY, EXPERIMENTAL

STIMULUS GENERALIZATION IN NORMALS AND RETARDATES ON A VISUAL-SPATIAL TASK REQUIRING A VOLUNTARY RESPONSE

(L. C. Card No. Mic 59-3490)

Charles D. Barnett, Ph.D. George Peabody College for Teachers, 1959

Major Professor: Gordon N. Cantor

The purpose of this study was to investigate empirically the generalization behavior of individuals of normal and retarded intellectual development. Specifically, the following were considered: (1) the shape of the generalization gradient of frequency of response obtained on a visual-spatial task requiring a voluntary response; (2) the shape of the generalization gradient of latency of a voluntary response; (3) a comparison of these gradients in normal and retarded Ss; and (4) the effects of two amounts of original training on subsequent generalization gradients of latency and frequency of response.

The apparatus consisted of a curved plywood panel on which 11 lamps were mounted in a horizontal row at nine degree intervals. All lamps were equidistant from the S's eyes when he was seated directly in front of and 3.5 ft. away from the center lamp. A reaction key was attached to an ordinary school desk which enabled the S to

turn off any light turned on by E.

Sixty institutionalized retardates and 60 high school juniors served as Ss. Both males and females were used. The retarded Ss had a mean CA of 18.41 years and a mean IQ of 50.08. The normal Ss had a mean CA of 17.03 years and a mean IQ of 102.27. Half the Ss in each intelligence group were randomly assigned to a treatment involving a low number of original training trials. The remaining Ss were assigned to a treatment involving a high number of original training trials.

Following instructions in which the S was told to lift his finger from the reaction key in response to the lighting of the center lamp, but not to react to the lighting of other lamps, the S was given one of two amounts of training in reacting to the center lamp alone. The High Group received 20 consecutive training trials as opposed to the Low Group's eight. Then, without warning or interruption, a series of test trials was administered in which six of the peripheral lamps were presented twice each, interspersed with additional presentations of the center lamp. All lamps appeared equally often in the first test position. The frequency and latency of generalized responses were recorded.

It was assumed that the original training series would build up a strong tendency to react to the center lamp and that this tendency would generalize to the other lamps on the basis of their physical proximity to the training lamp.

It was predicted that both intelligence groups would show regular decreasing gradients of response frequency, but that only the retarded Ss would show a regular decreasing rate gradient. It was also expected that the retarded Ss would manifest more generalization than the normals, that the high original training group would generalize more than the low, that there would be an interaction between intelligence groups and amount of training, and that there would be a triple interaction involving lamps, intelligence and amount of training.

The statistical analysis indicated the existence of fairly regular decreasing gradients of response frequency for both intelligence groups. Neither group manifested regular rate gradients. The intelligence groups failed to differ significantly in the amount of stimulus generalization (SG) manifested to the various lamps. There was a significantly greater amount of SG following a high number of original training trials than following a low number of such trials. The predicted interactions were not found.

Microfilm \$2.00; Xerox \$4.40. 84 pages.

THE ROLE OF PERCEPTUAL CUES IN THE DELAYED REACTION

(L. C. Card No. Mic 59-3536)

William D. Bliss, Ph.D. The University of Florida, 1959

This experiment was designed to test the hypothesis that perceptual cues such as simple designs, added to the doors of a delayed-reaction apparatus, do not make any difference in the performance of the delayed reaction.

A modified McCord delayed reaction apparatus was used. The modifications made were designed to eliminate some asymmetries in the apparatus which might have been used by subjects as cues to the correct response.

Two groups of albino rats were used in the experiment. An experimental group of 41 animals was run with simple designs on the doors of the apparatus, and a control group of 45 animals was run with the apparatus doors painted plain white.

A delay interval of one minute was chosen as the test interval. The hypothesis of the experiment was tested on the basis of the animals' performance over twenty trials

at the one-minute delay interval.

On the basis of both Chi-square and t-ratio tests of significance, the results indicated a significant difference in performance in favor of the experimental group. On the basis of these tests, the null hypothesis was rejected and it was concluded that such cues as simple geometrical designs, added to the perceptual situation in the manner of this experiment, are used by the animal and make an effective difference in performance.

Microfilm \$2.00; Xerox \$3.00. 40 pages.

OF THE JOINT EFFECTS OF DRIVE
AND INCENTIVE MOTIVATION

(L. C. Card No. Mic 59-3060)

Donald N. Buckner, Ph.D. University of Southern California, 1959

Chairman: Professor Guilford

The purpose of the study was to investigate the joint effects of the Hull-Spence motivational construct D, generalized drive, and incentive motivation, K, on human performance or reaction potential, E. Hull assumed that D and K

combine multiplicatively in their action on H, the associative or learning factor, to produce E. Spence assumed that D and K combine additively. An effort was made to test the hypothesis that D and K are additive by extending the Hull-Spence incentive construct to include an incentive that

is specific to human behavior.

D was varied by developing a conditioned fear response in one half of the Ss, 40 Navy apprentice seamen, and not in the other half of the Ss. The fear response was developed by pairing a tone-conditioned stimulus (CS) that was later present on all test trials for all Ss with an electric shock unconditioned stimulus (US). K was varied by providing one half of the Ss with an opportunity to obtain a 72-hour liberty depending upon their performance; the other half of the Ss were not given a similar opportunity. Thus, there were four experimental groups: low drivelow incentive; low drive-high incentive; high drive-low incentive; and high drive-high incentive. All groups received 45 training trials on a nine-choice disjunctive reaction time (RT) task. Following the training, the high incentive groups were given the incentive instructions and the high drive groups were given the conditioning trials. Then all groups were given 27 test trials. All Ss received an equal number of trials prior to the test trials. A 2 x 2 analysis of variance was performed, using information transmission scores, which reflected the accuracy of response, and RT scores as measures of performance.

Results. Considered in terms of accuracy of response, the low drive-high incentive group peformed as well on the 27 test trials as they did on the last 27 training trials, but the remaining three groups performed poorer on the test trials. The main effect due to variations in D was significant, but the direction of the effect was opposite to what would be predicted from the Hull-Spence formulations; that is, the high drive groups performed more poorly than the low drive groups. The main effect due to variations in K was not significant. Such significance could not be expected, however, since there was a significant interaction between D and K. At the low drive level, the increase in K served to increase the accuracy of response; but at the high drive level, the increase in K served either to decrease or not to increase the accuracy of response. The low drive-high incentive group performed significantly better than the remaining three groups.

The analyses of the RT scores produced no significant results, though all groups improved their RT performance from the training to the test trials, and the differences due to the experimental variations were in the directions that

would be predicted from the Hull-Spence formulations.

The results obtained by using combined accuracy and

RT scores were equivocal.

Conclusions: It was concluded that the effects of D and K were neither additive nor multiplicative when accuracy of response was used as the dependent measure and when

variations in K were produced by using what is generally regarded as a meaningful incentive to human Ss.

It appeared that the validity, or lack of validity, of the Spence hypothesis concerning the relationship between D and K depended on the response measure used.

Microfilm \$2.00; Xerox \$7.00. 146 pages.

### THE EFFECTS OF AGING ON THE COMPONENT MOVEMENTS OF HUMAN GAIT

(L. C. Card No. Mic 59-3192)

Donovan Riley Greene, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Karl U. Smith

The effects of aging on the component movements of human gait have been studied in a sample of 150 subjects ranging in age from 4 to 71 years. Four conditions of pace were investigated, normal, decelerated, accelerated and normal-unshod using an electronic method of motion analysis. The results confirm the central thesis of the theory underlying this study, i.e., that gait motions are a vital pattern of activity in the human system showing distinctive time consistency and stability over most of the life span. Moreover, specific hypotheses concerning the aging phenomena in gait, which were derived from the general space structured theory of human motion are, for the most part, confirmed by this study. The results can be summarized as follows:

Variations in the gait components from one day to the next are slight and statistically insignificant.

Males have significantly larger means on both the contact and travel time components, for all conditions of pace, than do females.

It has been established that the normal contact time is 0.72 seconds and the travel time 0.40 seconds per step-stride sequence.

The normal pace mean contact and travel times remain relatively consistent from age 12 to at least age 70.

The normal-unshod condition of pace has contact and travel means which closely parallel the normal pace means.

The subject's estimated speed of walking is considerably different from their actual performance speed. The decelerated half-pace was conceived of as a speed approximately 25 percent longer then the normal pace. The pace at which subjects thought they were doubling their normal pace was actually a speed 14 percent faster then their normal pace.

Aging tends to decrease one's ability to judge with accuracy the pace that is approximately one-half as fast as normal pace. This convergence toward the normal pace, as a function of aging, is not characteristic of the results when subjects perform at a pace judged to be twice as fast as normal.

Individual differences within age groups, particularly on the decelerated pace, in general, are greater than differences between age groups. Increasing the speed of pace tends to decrease the relative size of its standard deviation, especially for the contact time component.

The contact-travel ratios for the four conditions of pace remain consistent in their relationship to each other. This tempo relationship is slightly altered due to aging. The contact-travel ratios tend to increase in size as a function of aging.

The relationship between the contact and travel components and the physical measures of weight, height, nor-

mal stride and leg length is low.

A correlation of 0.60 was found between the travel and contact components in gait, and indicates a relatively high degree of movement coordination between these components.

The average subject's normal pace was found to be approximately two miles per hour. This fact and related results of this investigation indicate that a time study procedure employing gait as a standard performance index has limited if not incorrect application in setting time study standards and allowances for manual motions.

Microfilm \$2.00; Xerox \$6.20. 129 pages.

THE EFFECT ON VISUAL THRESHOLD OF LIGHT OUTSIDE THE TEST AREA

(L. C. Card No. Mic 59-3111)

Ira T. Kaplan, Ph.D. Columbia University, 1959

A circular test field was surrounded by several spots of light (inducers). The inducers were equidistant from the test field. The luminance threshold of the test field was determined as a function of the luminance, number and location of inducers in the fovea and in the periphery.

Test threshold rose as inducing luminance increased. When luminance was measured in log units, in the fovea the rate of rise increased as the inducing luminance increased, and in the periphery the rate of rise first increased, then decreased, then increased again.

Doubling the luminance of one inducer raised test threshold as much as adding a second inducer adjacent to the first.

Two or four inducers raised threshold more when they were evenly spaced around the test field than when they were grouped together on one side of the test field.

Test threshold rose as the number of inducers increased, but successive inducers produced decreasing increments in threshold log luminance. Similarly, successive equal increments in inducing luminance (real number scale) produced decreasing increments in threshold log luminance.

Changes in threshold were larger in the periphery than in the fovea. Microfilm \$2.00; Xerox \$3.00. 46 pages.

A SEQUENTIAL ANALYSIS OF BAR-PRESSING BEHAVIOR

(L. C. Card No. Mic 59-3330)

Glenn C. Kinney, Ph.D. University of Washington, 1959

Chairman: Moncrieff H. Smith, Jr.

The thesis reports an experimental examination of some relationships thought to hold between the rate at which rats press bars in a Skinner box and the sequential dependencies among this activity and others occurring with it as experimental conditions are varied. The method used applies a recently developed mathematical model to certain theoretical formulations of stimulus-response and response-response associations originally offered by Skinner and adopted by many contemporary learning theorists. The model provides a derivation of three hypoth-

eses whose tests in the experiment reflect directly upon assumptions underlying the theory.

The first hypothesis is that a hungry rat "exploring" in the Skinner box and being administered no food or other reward (operant level conditions) will exhibit a low and irregular rate of bar pressing associated with randomness of activities and sequences of activities. The second hypothesis states that when the animal is being rewarded with food offerings for every bar-press (regular reward conditions), the high and constant rate of bar pressing is associated with stereotypy of sequences of activities. The third hypothesis is that in the transition from operant level to regular reward behavior (acquisition), the rate of bar pressing is highly correlated with the development of the sequential stereotypy eventually learned.

The apparatus was a modified Skinner box in which three infrared light beams were located to record the animal's presence at various locations in the box. Kymographs provided data on time and sequential order of occurrence of light beams interruptions and bar presses.

The light beams and bar-presses were used to divide the animal's activities into four classes of events. These classes were treated as states in a finite Markhoff process, where this process and the method of its study provided the mathematical model.

Thirteen male albino rats were given three daily hours of operant level conditions, the last session providing the sample for sequential analysis. All rats were then given three daily sessions of regular reward, thirty rewards per session, and the last session was the sample for sequential analysis. Cumulative frequency of occurrence of states, pairs of states, and trios of states were examined for the test of the third hypothesis.

The choice of states introduced a bias into the results. A correction for this bias was derived and employed in the analysis.

It was concluded that the first hypothesis is false. Operant level behavior was not random, but variously composed of sequential dependencies extending over sequences of at least three, and perhaps more successively occurring states. The second hypothesis was rejected with qualifications; the behavior being less stereotyped than expected, but extending over sequences shorter in length than was the case in operant level. The third hypothesis was also rejected, it being concluded that rate of bar-pressing may or may not develop concomitantly with those sequential dependencies eventually involved with it.

It was also concluded that the apparatus bias spuriously introduced stereotypy into regular reward behavior. This effect partially accounts for theoretical expectations derived from more casual observation.

Several implications of these results were discussed. Among these is the relevance of the results to the interpretation of experiments using procedures whose effects upon sequential order of occurrence of an animal's activities are either unknown or unspecified.

In general, the experiment indicates that detailed statements about the sequential organization of behavior should not be made on the basis of evidence in the form of temporal distributions only.

Microfilm \$2.55; Xerox \$8.80. 194 pages.

### THE EFFECTS OF SHAPE AND CLOSURE ON THE TIME-ERROR

(L. C. Card No. Mic 59-3016)

John Lesser, Jr., Ph.D. University of Maryland, 1959

Supervisor: Dr. Thomas G. Andrews

The intent of this study was to investigate the effects of simple geometric shapes upon successive-comparison judgments of their size. Three different shapes, drawn in both continuous (closed) and broken lines (non-closed), were used. These were an ellipse, square and circle.

The psychophysical method of constant stimulus differences with three categories of response was used. Seven comparison stimuli per standard stimulus were presented in a specially constructed experimental apparatus. Time delays of (O), 1, 3 and 8 seconds were interpolated between presentations of the standard and comparison stimuli. Each of 17 subjects made 140 judgments per standard stimulus at each of the four time delays. Thus, each subject made 560 judgments per standard stimulus and a total of 3360 judgments for six standard stimuli at four time delays.

From the responses, individual PSEs were calculated and averaged so as to obtain mean PSEs at each time delay for each standard stimulus. The mean PSEs were used to generate time-error functions. These functions were tested for trend by analyses of variance. In two instances, a significant trend was indicated. This occured with the time-error functions both for the broken line ellipse and square. The function for the broken line ellipse was very much like the classical negative time-error, showing an increasingly larger negative time-error with longer time delays. The function for the broken line square was quite unusual. The function was positive and rose rapidly from the zero to the three second delay point and, then, declined rapidly to virtually no error at the eight second delay. The functions for the other four standard stimuli were straight-line functions for the most part. Other analyses indicated that the time error functions for the broken line ellipse and broken line square were significantly different from each other and the remaining four functions, as well, at the longer time delays.

In regard to these findings, it was concluded that continuous line drawings of different shapes have no differential effect upon time-errors. Further, it was concluded that simple Gestalt hypotheses do not adequately predict time-errors for judgments of visual area. Therefore, a different theoretical approach was offered, whereby, shape producing contour is regarded as having a perceptually primary effect and in interaction with non-closure determines the magnitude and shape of time-error functions. Experimental contingencies like the duration of stimulus presentation and the size of frame around presented stimuli were posited as determining the direction of the time-error function. Microfilm \$2.00; Xerox \$4.40. 81 pages.

#### PSYCHOLOGICAL ASPECTS OF ENERGETICS

(L. C. Card No. Mic 59-3364)

Bernard Moskowitz, Ph.D. The University of Oklahoma, 1959

Major Professor: Carl R. Oldroys

System theory was presented as a framework which might possibly lead to unifying principles both within psychology and between psychology and the physical and biological sciences. The work of Bertalanffy, Zipf, Freeman, and others was reviewed and evaluated as contributions to system theory. Freeman's Energetics of Human Behavior, an open system view of psychological functioning, was the point of departure for five experiments in human energetics.

In the first experiment on stress and the EDR (electrodermal response, a measure of energy), it was hypothesized that, if subjects were overmobilized, their performance would deteriorate. Unfortunately, the situation chosen did not produce stress, much less overmobilization.

The second experiment on shifts of set tested the hypothesis that significantly more energy should be expended in performing simple arithmetic problems with the operations of adding, subtracting, multiplying, and dividing scrambled rather than in uniform groups. In part of the experiment the regressed EDR curve had the expected slope. The results suggested that subjects require an adaptation period before changes due to shifts of set could be demonstrated.

In the distraction and EDR experiment, it was hypothesized that regressed EDR scores would show significant differences due to degrees of distraction. Intensity levels of the interfering tasks were significant. There were no significant differences between the two task groups and the control group. It was felt that the interaction of expectancy residuals complicated the picture.

A nondirective interview over twelve items from an adjustment inventory was carried out in the ego-involvement and EDR experiment. The subject and two clinical psychology trainees used a five point scale to classify the degree of ego-involvement for each item. A significant relationship between ego-involvement and EDR was hypothesized. An eta of .34 was obtained for the relationship between EDR and the clinicians' estimates of ego-involvement.

It was hypothesized that there would be significant differences in EDR between completed and noncompleted perceptual tasks in the perception and EDR experiment. It was felt that the lack of involvement and the counterbalanced design could have operated to obscure the expected results.

In general, of the five experiments, the ego-involvement experiment fulfilled its specific hypothesis. The distraction and the shifts of set experiments fulfilled part of their specific hypotheses. With hindsight, it would appear that the explanations of the failure to obtain positive results in the remaining two experiments, as well as in parts of the distraction and shifts of set experiments, can be marshalled in support of the principles of energetics presented. In the discussion for each experiment, specific analyses and recommendations for future experimentation were presented.

Microfilm \$2.00; Xerox \$6.80. 143 pages.

THE INFLUENCE OF EXTRA-TEST STIMULI ON THE CRITICAL FLICKER FREQUENCY OF THE HUMAN FOVEA

(L. C. Card No. Mic 59-3125)

Harris Ripps, Ph.D. Columbia University, 1959

The purpose of this experiment is to investigate the way in which foveal critical flicker frequency (CFF) is altered as a function of the intensity, and varying with the locus, of extra-test stimulation.

A dual beam photostimulator presented the test and inducing fields in Maxwellian view. The foveally fixated test field, either a hemisphere 22 minutes of visual angle in radius or a circular area 30 minutes in diameter, was periodically interrupted to provide equal light to dark ratios. The inducing field was, in all instances, a steady luminous field, but was varied in form and locus in accordance with the dictates of the experimental procedure. Test field CFF was studied as a function of the inducing field luminance over a wide range of test luminance levels.

Veiling luminance, which constitutes a large luminous background superimposed upon the test field and its surrounding regions, produces a complex change in test-field CFF. As veiling luminance is raised from threshold visibility there is, at first, no change in test-field CFF. With further increase in veiling luminance, CFF gradually increases, passes through a maximum, and then falls

abruptly, at high veiling luminance, to levels far below that of the test field alone. Analysis of the component parts of the veiling luminance configuration indicates that illumination of the region surrounding the test area is responsible for the increase in CFF, since the only effect of a steady luminous field superimposed upon the test field is to diminish CFF. When the luminance of the superimposed component is high relative to that of the test region, a sharp decline in CFF results. The combined effects of these components closely approximate the experimentally derived veiling luminance function.

It has been shown that the effect which is obtained with a patch of veiling luminance extending 0.25 degrees beyond the borders of the test field is approximately the same as for a region extending more than 1.25 degrees beyond the limits of the test field. Thus, compared with the region of contiguity, regions not far removed from the test field do not contribute significantly to the effect upon CFF.

The results obtained with a non-contiguous inducing field support the hypothesis that the influence of illumination somewhat removed from the test locale is due to the stray light incident upon the test region and its surround.

Subjective reports of test-field apparent brightness indicate that a rise in CFF is not necessarily accompanied by a similar change in apparent brightness. Under certain conditions of extra-test stimulation, maximum values of CFF may occur when test-field apparent brightness is markedly reduced.

Microfilm \$2.00; Xerox \$3.80. 67 pages.

#### RELIGION

JOHN WESLEY'S CONCEPT OF PERFECTION

(L. C. Card No. Mic 59-3790)

Leo George Cox, Ph.D. State University of Iowa, 1959

Chairman: Assistant Professor James C. Spalding

Purpose and Problems:

John Wesley bequeathed his doctrine of Christian perfection as his "grand depositum" for the people called Methodists. Among Wesley's successors have come varied interpretations of this doctrine. It was evident that there were certain problems in the teaching that needed solution. The purpose of this study was to set forth Wesley's view as clearly as possible in order to discover his answers to the special problems posed in these following questions:

- 1. What is the relationship between the doctrine of holiness as Wesley taught it and the concept of continued sinfulness in the believer?
- 2. How is it possible to be perfect in this life where there are limitations and imperfections?
- 3. If Christian perfection is freedom from sin, how can the Christian claim such when there are failures, shortcomings, and mistakes in his conduct?
- 4. Would not any claim to the attainment of perfection jeopardize the sola gratia and the sola fide?

Methods and Procedure:

The writings of John Wesley were examined for his teachings on sin, grace, faith, justification, regeneration, and sanctification. Various writers dealing with Wesley's theology were studied and their findings were compared with Wesley's view. Recent studies on Wesley were critically evaluated. Wesley's ideas were compared with the views of Martin Luther, John Calvin, and various Reformed and Neo-Protestant theologians.

After the collection of the materials the following method of organization was pursued:

- Wesley's concept of sin was summarized and his variations from the Reformers were noted. This approach involved a discussion of grace, along with faith and good works.
- 2. The various stages in perfection as held by Wesley were outlined as they are related to the order of salvation. The relationship of instantaneous to gradual sanctification was given.

3. What Wesley meant by present perfection was examined, including his ideas on assurance, freedom from sin, testimony, and perfect love.

4. Finally, Wesley's attitude toward the human limitations and failures still present with the entirely sanctified was examined, and his opinion that perfect love is consistent with these was explored.

#### Conclusions:

1. Wesley's concept of sin and grace was such that both the sola fide and the sola gratia are retained.

2. The operation of God's grace is such that salvation is progressive with various stages. At one crisis justification and regeneration are given in response to faith; at a later crisis the sanctification, begun at regeneration, is made entire by a further act of faith. Neither of these crises bring a final perfection.

3. Entire sanctification, which is the present perfection, is only a stage in the gradual sanctification, and is best expressed as a pure heart where love alone reigns.

4. Freedom from sin, which is the sanctification that is entire, is the freedom from any rival to the perfect love for God.

5. Gradual sanctification, or the emergence of holiness into every part of man's nature, continues throughout life without completion until the resurrection.

6. Wesley did not confine his definition of sin to a voluntary transgression of a known law. The evil desires remaining in the believer are sins while even the involuntary transgressions of the entirely sanctified are "sins" that need atonement.

7. Wesley was in agreement with the Reformers on the concept that the holiest of men feel most deeply their unworthiness and their need for mercy.

8. Wesley insisted on a drastic inward change wrought by God's grace in the believer. This inward holiness was in the believer, but not from him, and was continually mediated by the Holy Spirit in response to faith.

Microfilm \$5.10; Xerox \$17.00. 400 pages.

A PROLEGOMENON TO A THEOLOGY OF THE WORD BASED UPON A THEORY OF THE MIND AS ESSENTIALLY SYMBOLIZING IN ITS FUNCTION

(L. C. Card No. Mic 59-3798)
Richard W Hostetler, Ph.D.

Richard W. Hostetler, Ph.D. State University of Iowa, 1959

Chairman: Assistant Professor James C. Spalding

Chapter I, "The Symbolizing Function of the Mind," contains the thesis that mental apprehension and expression employ symbols not merely as accidental characteristics of thought but as its essence. The consequent elaboration of this thesis takes into account the growing tendency of physical science to transcend "common-sense" language and descriptiveness, and to operate predictively almost entirely on the level of mathematical symbols. The effusive symbolism of the mind is further indicated by reference to Freud's theories of psychoanalysis. Freud relies on the imagery and symbolisms of the dreamconsciousness by the interpretation of which treatment can be rendered in the case of compulsive neurosis. Freud also deals with the primitive tribal mind by a comparable analysis of its mythic expression. Discussion of Cassirer's examination of primitive myth also tends to support this thesis of the essentially symbolizing function of the mind. Crucial to an understanding of symbolic apprehension and expression is the distinction between a "sign" as a behavioral cue to action, while a symbol implies "understanding," a peculiarly human response and a meaning which is distinctively conceptual.

Chapter II, "The Function of Words in Symbolic Expression," contains an argument against various contemporary forms of nominalism which attempt to reduce language to an arbitrary or conventional system of signs. In such works as Ogden and Richards' The Meaning of Meaning and A. J. Ayer's Language, Truth and Logic "logical analysis" is used in an attempt to legislate out of the realm of that which is "meaningful" all propositions which do not conform to an empirical standard of meaning. Further examination of language seems to disclose, however, metalogical, metaphorical and intuitive factors without which new meanings cannot be projected. The ideal language, therefore, is not a "literal copy" nor a strictly utilitarian, denotative system of signs. It must include a representational or metaphorical element.

Chapter III, entitled "The Value-Structure of the Media of Art and Language," represents a denial of the assertion by W. M. Urban that meaning is so closely dependent upon linguistic expression that outside language there is only an activist, behavioral meaning. The theological doctrine of the logos as encompassing that aspect of intelligibility and order in the events of the external, phenomenal world, as well as the corresponding principle of rationality and understanding within man, sets forth a concept of meaning which is supra-linguistic. Man, states Zurdeeg, is of the category homo convictus in order that he may be homo loquens. Because of this factor all great art, it is argued, is not pure form or presentational but representational, containing the metaperceptual. In the use of his media the artist not only skilfully utilizes it to enhance the main intent of the art-work but finds that the form or media which he employs also contains the negative which impedes and inhibits the communication of pure meaning.

In the final and fourth chapter, "Symbolism and Revelation," an attempt is made to view revealed truth from the viewpoint of the philosophy of symbolism previously elaborated. The language of religion is negative both because of the incompleteness of human knowledge and because of its inadequacy when finitely forced to describe that which is Infinite. In Barth's concept of revelation we find a further negativity in the revealed fact of the Fall in which divine meaning is refracted and distorted. That God's Word is in the words of Scripture is a confession of faith analogous to the doctrine of the Incarnation where the presence of the Divine is perceptible only to faith and not self-evidently.

Microfilm \$3.75; Xerox \$12.60. 290 pages.

THE BOOK OF ACTS AS A SOURCE FOR THE STUDY OF THE LIFE OF PAUL

(L. C. Card No. Mic 59-3064)

Paul Edward Howard, Ph.D. University of Southern California, 1959

Chairman: Professor Titus

The primary purpose of this study was to determine to what extent the book of Acts may be considered historically reliable in its representation of the apostle Paul.

A secondary objective was to discover the author's purpose in writing Acts in order to determine if it was written for the purpose of supplying biographical data about Paul.

Findings. An analysis of the author's use of sources was undertaken. This involved a comparison of Luke's use of his Marcan source in the gospel portion of his work and the use of possible sources in Acts. It was discovered that Luke was not entirely dependent upon his sources; his additions, omissions, and changes reveal him to be a writer who shrewdly adapted his sources to his own peculiar purpose. It is in the seemingly slight and insignificant modifications which he made in his sources that Luke is revealed as an author of considerable skill.

Luke's use of his sources disclosed the following characteristic emphases: (1) A concern to exonerate the Christian church from the charge of being politically dangerous to the Roman Empire, (2) his portrayal of the church as the true Israel which was entitled to the rights of a religio licita, (3) his revelation of how the true "Spirit" was at work in the Christian faith, and (4) the fact that Christians were concerned about the welfare of all classes of people.

The disagreements and inconsistencies which were found in a comparison of Acts and Paul's letters forbid the consideration of Luke's having been a companion of Paul and thus intimately acquainted with his life and work. The differences are such as might be expected from an author removed from the events he reports by a generation or more.

The apologetic interests of writers were sanctioned by ancient standards of historiography. The literary character of Acts reveals that Luke used such literary devices as (1) the preface, (2) the speeches, and (3) the "we" sections in furthering his apologetic interests. An examination of the assumed purposes behind Luke's writings eliminated the possibility of his having written for the purpose of furnishing a biography of Paul.

Conclusion. The results indicate that the reliability which can be expected to be found in Acts is controlled by (1) Luke's treatment of his sources and the changes he made in them, often amounting to distortion of the original source; (2) the unlikelihood of Luke's having been a companion of Paul and, having written a generation or more after the events he narrated, his dependence upon either fallible memory or the necessity of relying heavily upon his source material, whether oral or written; (3) the degree to which Luke conformed to the literary standards of his day and permitted apologetic interests to dominate; and (4) the consistent manner in which everything was subordinated to the attainment of Luke's purpose. Thus, it can be seen that Luke is seriously inadequate as a reliable source for Paul's life, except in those areas where there is agreement with Paul's letters.

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Microfilm \$4.20; Xerox \$14.20. 328 pages.

THE IMPLICATIONS OF FORM CRITICISM FOR A KNOWLEDGE OF THE HISTORICAL JESUS

(L. C. Card No. Mic 59-3065)

Samuel Ferdinand Nelson, Ph.D. University of Southern California, 1959

Chairman: Professor Titus

The form criticism of the Gospels bears certain implications for the integrity of the tradition as testimony for the historical Jesus. The objective in the present study was the identification and evaluation of these implications.

The work of three scholars in this field served as the basis for the analysis: Rudolf Bultmann, Martin Dibelius, and Vincent Taylor. An examination of their conclusions revealed two possibilities: (1) the securing of more precise results by a stricter application of the principles of form criticism before recourse is had to historical criticism of content and (2) the clarification of the place and influence of the Christian community as a creative agent in the formation and transmission of the tradition by a sharpening of the so-called "laws" of transmission through a judicious application of the psychological principles of perception, motivation, group influence, etc.

A special problem for which none of the scholars studied had offered a clear solution was the form criticism of the sayings materials. The evaluation of these materials is rendered especially difficult because much of this tradition cannot be distinguished by form from didactic materials in other contemporary cultures. The solution offered in the present study is based upon an accepted hypothesis of form criticism, namely, that the motives of the early church, as revealed in its interests and purposes, determined the preservation and formation of the gospel tradition. The paradigms are the most easily identified of the forms and are demonstrably related to the earliest activities of the church: the proclamation of the Gospel and controversy with the rabbinical schools. From this earliest stratum of tradition the "drive-pattern" of the church in the earliest period can be determined. This drive-pattern led to the recall and preservation of the narratives classified as paradigms and must also have determined, during the same historical period, the preservation and transmission of Jesus' sayings. The paradigms contain the earliest interpretation of the historical Jesus by the early church and thus furnish a clue in distinguishing the most probably authentic of his sayings.

The following characteristics of the historical Jesus are derived from this most primitive stratum of the tradition composed of paradigms and sayings: (1) Jesus was the herald of the kingdom of God and his presence and his message were its signs. (2) Jesus' preaching was eschatological in emphasis. His own miracles and preaching were the evidence that the Reign of God was beginning. (3) His ministry was analogous to that of the Suffering Servant of deutero-Isaiah, but the earliest stratum of tradition contains no citation or allusion which clearly reflects it. (4) Jesus' eschatological message was accompanied by the highest of ethical demands: the two elements are closely bound together.

The narratives which were classified under the terms "miracle stories" and "biographical stories" must be assigned, on the basis strictly of form, to a later period in the primitive church's expansion, and are thus to be

considered secondary evidence for the historical Jesus. Even as such, however, they are important testimony to the persistence of certain traditions concerning Jesus: his death on the cross and the events related to it, his lowly birth and his special ministry to those who had the greatest sense of personal need—the poor, the ill, and the outcast.

The study of the forms of the tradition and their development supports the conclusion that Jesus was a historical figure and that the main lines of teaching ascribed to him by the Gospels are authentic.

Microfilm \$4.40; Xerox \$14.80. 343 pages.

A COMPARATIVE STUDY OF CERTAIN ALLEGED SIMILARITIES BETWEEN THE LITERATURE OF QUMRAN AND THE FOURTH GOSPEL

(L. C. Card No. Mic 59-3068)

Dodava George Vanderlip, Ph.D. University of Southern California, 1959

Chairman: Professor Titus

Shortly after the discoveries of the literature of Qumran, assertions were made that these writings reflect the same general background as that found in the Fourth Gospel. It is claimed by some that the Fourth Gospel was directly influenced by the Dead Sea Covenanters. The areas in which it is stated that the two literatures are the most similar are threefold: (1) the stress on religious knowledge, (2) the strong religious dualism, (3) the attitude toward the cultus of established Judaism. This dissertation examines each of the above three areas in an effort to discover whether or not it appears to be valid to say that the Fourth Gospel was directly influenced by the literature of Qumran.

Both Qumran and the Fourth Gospel were found to share the Old Testament concept of knowledge as experiential and existential. The knowledge of Qumran has the following distinguishing characteristics: (1) it is eschatological; (2) it is esoteric; (3) it involves a correct understanding of, and obedience to, strict legal regulations as taught by the sect; (4) it comes to a person through joining the sect, submitting to its regulations, and sharing in its secrets. Knowledge in John comes through believing in Jesus as the Christ. This knowledge does not share the eschatological, esoteric, or legal connotations connected with it in the scrolls. Knowledge in the Fourth Gospel means basically fellowship with God.

The dualism in the literature of Qumran is religious and ethical, not metaphysical. It is not eternal, for it came into existence through the activity of God and it will someday end. In the Fourth Gospel the dualism is also religious and neither absolute nor final. Whereas in the scrolls the dualism is presented as existing both within man and independently of him, in the Fourth Gospel it tends to be regarded as basically external to man and not internal. The dualism in the scrolls is climaxed in a physical conflict between the sons of light and the sons of darkness. In John the cross is the hour of triumph. That which makes one a child of light in the scrolls is living according to the strict regulations of the Qumran community. In the case of John one becomes a child of light by believing in Jesus as the Christ. A study of contemporary literature shows that the dualism which the scrolls and John had in common was current and widespread in the theological thought world of the day. Both literatures would appear to share in this thought world and to be independent witnesses to it.

Both literatures take a negative attitude toward the cultus of Judaism. The Qumranians looked forward to the overthrow of the established cultus and to the restoration of the sacrifices in purity. The Fourth Gospel looked forward to no such restoration. The light of the world has come. The time of fulfillment is now.

This study concluded that there is no evidence for a direct relationship between the literature of Qumran and the Fourth Gospel. Similarities of terminology are not usually similarities of meaning. In those areas where they have elements in common, it would appear to be better to say that they have drawn water from the same well rather than that there has been any direct flow from one to the other. Microfilm \$3.45; Xerox \$11.80. 268 pages.

### SOCIAL PSYCHOLOGY

UNION AND MANAGEMENT TRAINEES—
A COMPARATIVE STUDY OF PERSONALITY
AND OCCUPATIONAL CHOICE

(L. C. Card No. Mic 59-2838)

Howard M. Bogard, Ph.D. Columbia University, 1959

In an attempt to study further the relationship of personality to occupational entry the present investigation undertook to determine whether individuals, who were considered by top union and management executives to possess skills which would make them worthy material for training for leadership positions, were different from each other.

Forty students enrolled in the Leadership Training Institute of the International Ladies Garment Workers Union and forty trainees employed by the Grace Line were selected for study. Their job duties and entrance requirements were analyzed; and after a review of the literature regarding trade union and management leaders, the following traits were selected as most likely to reveal intergroup differences:

- 1. Social class identification.
- 2. Values.
- 3. Personality characteristics
- 4. Biographical and developmental experiences.

Due to the limited availability of the subject groups, the tests had to be group administered and to require as

little time as possible. The battery subsequently employed was composed of the Sims SCI Occupational Rating Scale, the Allport-Vernon-Lindzey Study of Values, the California Psychological Inventory and a custom built, trait centered Biographical Inventory.

The two groups were similar in age. A mental abilities test administered to both the union and management groups revealed a significant group difference, favoring the management trainees. Correlation ratios were accordingly computed between intelligence test scores and the subjects' scores on the regular test battery. All of the ratios, with the exception of that for social values, were very low and suggested that any group differences that did appear between the ILGWU and the Grace Line subjects, would be the result of some factor other than intelligence.

Fifteen hypotheses were tested for significance with t tests employing the 5 per cent level as the minimum

criterion for acceptance.

From the results it appeared that the ILGWU trainees, though less intelligent and less aggressive than the Grace Line group, tended to score above the general population in both of these traits. The union men were more altruistic than the management trainees, less concerned with doing things that are "practical" and revealed a greater number of feminine interests. Their social class identification was significantly lower than that of the management group. The ILGWU trainees appeared to be less responsible, tended to demonstrate less social maturity and revealed a long standing propensity to overt conflict with authority figures.

During their formative years the management trainees appeared to have been more successful in their peer group relations, to have received less early independence training and to have been reared by parents who were generally more concerned with doing as their neighbors did than

were those of the ILGWU students.

Though the majority of the hypotheses investigated produced statistically significant intergroup differences, the confidence with which one can put the results to wide effective use is markedly impaired by the degree of overlapping. Individual scores were frequently such that they could have placed the subject in either of the groups studied. The present role and the future progress within the occupation of the intragroup variant is, however, of obvious future interest.

The results particularly point to the need for psychologically oriented job analysis in investigations of this type and to the discriminating ability of custom built, trait centered biographical inventories and the Allport-Vernon-Lindzey Study of Values. Personality factors, in the present study, do appear to have had a bearing on occupational choice. The two groups studied were seen to differ in a number of significant characteristics; and it appears that investigations which preface instrument choice by job analyses and which employ carefully constructed test batteries rather than single instruments, will very likely continue to provide data which supports occupational personality theory.

Microfilm \$2.00; Xerox \$5.20. 104 pages.

Persoculity characteristics

TYPES OF SUPERVISORS AND ASSOCIATED ATTITUDES OF SUBORDINATES

(L. C. Card No. Mic 59-3070)

James Howard Bryant, Ph.D. Louisiana State University, 1959

Supervisor: Professor B. M. Bass

The purposes of this research were (1) to identify types of supervisors on the basis of the supervisor's self evaluations and evaluations of the supervisor made by superiors and by peers; and (2) to determine what, if any, effect the supervisory types had on subordinates' attitudes toward a number of components of the work situation.

A sample of 45 Navy Chief Petty Officers completed an eleven item questionnaire pertaining to aspects of their supervisory performance. The same chiefs were evaluated on twelve characteristics by their superior officers and again by their fellow chiefs. Using these 35 dichotomously scored ratings, an inverse iterative factor analysis was performed which resulted in the isolation of six types of supervisors which were different from each other on these variables. A subsequent, direct principal axis factor analysis of the ratings revealed that four factors could account for most of the variance in the ratings. The factors were identified as Esteem-by-Peers, Esteem-by-Superiors, Career Satisfaction, and Personal Control. The types were compared on these four factors.

Chief Type 1 was relatively highly esteemed by both peers and superiors, but was highly dissatisfied with his career in the Navy, and only slightly above average in personal control. Chief Type 2 was poorly regarded by other chiefs, but highly esteemed by superiors, very highly satisfied with his Navy career and well above average in personal control. Type 3 was uniformly average on all four of these factors, while Chief Type 4 was similar to Chief Type 2, being poorly regarded by peers, but highly esteemed by superiors. Chief Type 4, however, was only slightly above average in career satisfaction and only slightly higher in personal control. Type 5 was almost the reverse, highly esteemed by peers, poorly regarded by officers, but about average on the other two factors. Chief Type 6 was neither esteemed by peers nor superiors, was relatively dissatisfied with his Navy career and well below average in personal control.

A 28 item attitude questionnaire was administered to the 559 men who worked under the 45 chiefs. The items were subjected to a direct principal axis factor analysis and four factors obtained: Attraction to the Navy, Attraction to One's Work Group, Attraction to One's Chief, and Attraction to Navy Personnel. Individual questionnaires were re-scored with factor scoring keys. To determine whether or not there were differences between chief types with regard to these factors, four groups-within-treatments design analyses of variance were computed, using the work group as the unit of analysis. Significant differences were found between types on the last three attitude factors; the differences between types on the first were not significant, but the probability that the differences were due to chance only was .06. All four factors were considered in comparing the chief types.

Since many of the other variables which might have been expected to effect subordinates' attitudes seemed to be randomly distributed within chief types, the last analysis was interpreted as indicating that the type of supervisor had a significant effect on the attitudes of their subordinates, as measured by the instruments used in this study.

Most favorable attitudes were found in work groups under Chief Types 2 and 4, whereas least favorable attitudes were found in groups under Chief Type 3. Groups under Chief Type 1 were above average in attraction to their chief, but about average otherwise. The attitudes of the groups under Chief Type 5 were about average across the board. The same was true of the groups under Chief Type 6, with the exception that they expressed above average attraction to their groups. A number of conclusions and implications, regarding type of supervisor and work group attitudes, were discussed.

Microfilm \$2.00; Xerox \$6.40. 131 pages.

### PHYSICIANS IN BUREAUCRACY: A CASE STUDY OF PROFESSIONAL PRESSURES ON ORGANIZATIONAL ROLES

(L. C. Card No. Mic 59-2845)

Mary E. Weber Goss, Ph.D. Columbia University, 1959

Sociologists have held that bureaucratic and professional norms tend to be incompatible if not contradictory. It has therefore been assumed that professionals at work in bureaucratic organizations experience strain and tension in living up to their diverse obligations. Yet little empirical evidence has been assembled to test this assumption. Moreover, it is possible that professionals affect as well as are affected by bureaucratic forms of organization. The present investigation explores this possibility in the case of a group of physicians forming a division of a hospital. The study takes as problematic the occurrence of strains resulting from contradictions between the requirements of organizational and professional roles, and tries to search out structural mechanisms that serve to reconcile such contradictions.

Data were gathered primarily through intermittent participant observation over a period of five years (1952-1957), and secondarily through study of organizational documents and questionnaires filled out by physicians. The research site is the Comprehensive Care and Teaching Program (CC&TP) of the New York Hospital-Cornell Medical Center. Located mainly in two out-patient clinics, the CC&TP yearly provides medical care for several thousand patients and clinical instruction for all fourth-year medical students at Cornell. Along with a small number of nurses, social workers, and other hospital personnel, some eighty physicians participate in the Program. Most of these physicians serve on a part-time unpaid basis but some are salaried full-time employees; all are on the staffs of both the Hospital and the Medical College.

The investigation centered on two areas of potential strain and adjustment: authority and the division of labor. In both areas, bureaucratic and professional norms and practices proved to be closely interwoven in ways that apparently produced relatively few tensions and little strain for the physicians in the organization.

Physicians were hierarchically organized in order to facilitate coordination and supervision of their work. The

hierarchy was basically regulated by professional standards. In the sphere of administration, physicians in formally superordinate positions could and did exercise authoritative control; as is generally true of bureaucracies, formal rank was the basis for effective authority in strictly administrative matters. But when physicians of higher rank in the bureaucracy supervised the care given patients by other physicians, they took the role of consultant and offered only advice rather than imposing orders. Such advice could be legitimately accepted or rejected, depending on the physician's own professional judgment. In this sphere, the technical expertness of a physician was the primary basis for his right to offer advice. As is generally true of bureaucracy also, work was divided among physicians in the CC&TP according to their specialized qualifications. Yet in accord with professional values concerning the importance of self-government as well as of giving service, physicians rather than specially-trained lay administrators held the major administrative posts and regularly combined these duties with more professional activities (service, teaching, research).

These and related finding provide the basis for the following conclusions, which are put forward as hypotheses for systematic investigation in formal organizations composed primarily of physicians or other professionals. (1) Professional norms and values set distinct limits to the ways in which organizational needs for policy-making, coordination, and supervision are met, and thus markedly affect the definition of organizational roles. (2) To reconcile professional norms and values with organizational needs, certain non-bureaucratic structural mechanisms are required. These include (a) a system of dual control (formal authority and formal advisory relations) within a single hierarchy of positions, where those with higher formal rank (b) have sufficient technical competence to qualify as expert consultants in the eyes of the professionals whose work they supervise, and (c) are assigned professional as well as administrative duties so that the latter occupy only part of their working time. (3) An organization with these characteristics can be classified as a semi-bureaucracy; it is a combination of the pattern Gouldner has described as "representative" bureaucracy and the pattern identified in this study as "advisory" bureaucracy. Microfilm \$2.80; Xerox \$9.60. 213 pages.

#### ROLE-TAKING: EMPATHY AND TRANSPARENCY

(L. C. Card No. Mic 59-3807)

Gary M. Maranell, Ph.D. State University of Iowa, 1959

Chairman: Professor Manford H. Kuhn

This study is the report or two investigations into the role-taking process. The orientation of this research and conceptualization is self theory stemming from the work of George H. Mead. Role-taking, the phenomenon under investigation, is defined as the "imaginative assuming of the position or point of view of another person" or "as-if" behavior; a person thinks, acts, or responds as if he were someone else. A common way of referring to the process is the "putting of oneself in another's place." This

phenomenon is of crucial importance to the self theorist. His orientation holds it as instrumental in the socialization process, for it is through role-taking that the individual develops a self concept. A deficiency in role-taking ability is held to create the distortion in perception of others which results in distortion of self-perception. The individual experiencing such a distortion is likely to indulge in inappropriate, non-conforming behavior.

We have in this research attempted three endeavors: (1) a conceptualization of the elements of the role-taking process, (2) a study of the effects of the situational dimensions of the process, and (3) a study of the correlates of the personality dimension. In the first of these areas we have abstracted five elements of role-taking which comprise two dimensions: (1) personality components and (2) situational components. The personality components include (a) empathy -- the ability of a person to take another's role, (b) general transparency--the ease with which one's role is taken, (c) idiosyncratic transparency-the effect of ego's and alter's personalities upon one another. The situational components include (a) coerced transparency--the transparency created by the roles played and the flow of communication, (b) content transparency--the transparency created by the content of the interaction. This taxonomy of elements of the role-taking process was then employed to establish areas of research. The two studies of this research are derived from this conceptualization.

The first study investigates the effect of coerced transparency by systematically controlling empathy, general transparency and idiosyncratic transparency. Individuals were randomly assigned to one of three roles: communicator (X), communicator-communication receiver (Y), and communication receiver (P). Each participating individual

serially occupied each of the three roles, with two new partners each time. It was discovered that roles (Y) communicator-communication receiver, and (P) communication receiver, were significantly more sensitive than role X, communicator, and were nearly equivalent to one another in sensitivity. The explanation advanced is that communication reception and the experience derived from it create sensitivity.

The second study is an attempt to examine the correlates of empathic ability. The study controls general transparency, idiosyncratic transparency, coerced transparency and content transparency. This was attempted by having the participating subjects all "empathize" with each of four lecturers. The summated right score was the gauge of empathic ability. Various attitude scales were also administered, including a self-attitude test. It was discovered, as hypothesized, that individuals who made derogating self-references or possessed fundamentalistic attitudes were unempathic. It also was discovered, as hypothesized, that sex and social class differences do not exist in empathic ability. In addition, individuals of different empathic ability were found not to differ in regard to aesthetic attitudes, authoritarian attitudes or atheistictheistic attitudes.

The studies were different in many respects, however, an integration was attempted which interpreted their relationship by postulating that fundamentalistic attitudes and self-disrespect are individual conditions which remove their holders from the communication reception position of the society, the college community in this case. This consequently inhibits the role-taking ability of the fundamentalist and the self-derogator and causes the fully participating individual to seem non-transparent to him.

Microfilm \$3.50; Xerox \$12.00. 272 pages.

#### SOCIOLOGY

SOCIOLOGY, GENERAL

THE EFFECTS OF INVOLUNTARY SEPARATION ON SELECTED FAMILIES OF MEN COMMITTED TO PRISON FROM SPOKANE COUNTY, WASHINGTON

(L. C. Card No. Mic 59-3147)

James Edward Blackwell, Ph.D. State College of Washington, 1959

The major objective of this study was to discover factors which would be fruitful in predicting how families adjust to involuntary separation resulting from imprisonment. A second objective was to determine the significance of a family's perception of involuntary separation as a crisis and as a factor relating to adjustment to separation.

"Crisis" was the theoretical oreintation within which this study was conducted. Crisis was operationally defined as a situation that produces hardships for the family, alters the family resources, and is perceived as a crisis by the families involved. This conception of crisis was juxtaposed against the broader construct of family disorganization.

Questionnaire and interview data were collected from eighty inmates and forty-eight wives of inmates. These data consisted primarily of responses to adaptation of the Burgess-Cottrell Marital Adjustment Scale, Hill's Adjustment of the Family to the Separation Scale, Duvall's Social Participation Scale, other background, social, economic, and family factors relating to problems of crime and crisis.

The hypotheses were tested by simple, partial, and multiple correlation techniques. The variables and their relationships were tested for significance at the .05 level of confidence.

Four major hypotheses were tested in the study. Hypothesis 1 stated: The adjustment of the family to enforced separation is a function of the type of marital adjustment that existed between the spouses prior to the separation. This hypothesis was supported. The first sub-hypothesis of hypothesis 1 stated that wherever demoralization occurs, as represented by divorce or plans for divorce, it is due to the conditions that existed in the family prior to the separation by imprisonment, and is not directly attributed to the imprisonment itself. This hypothesis could be neither confirmed nor rejected. The

second sub-hypothesis of hypothesis 1 stated that the adjustment of the family to the separation is dependent upon and can be predicted by a special group of variables that included background factors, marital relations, economic and social life, and factors relating more specifically with the crime and the separation. This sub-hypothesis was supported.

Hypothesis 2 stated: The adjustment of the family to the separation is dependent upon the wife's perception of the imprisonment situation as a crisis. Families that do not define the imprisonment as a crisis will rank higher on the adjustment scale than those who do define the situation as a crisis. The latter part of the hypothesis was rejected. The first part, however, implied that crisisprone families could be differentiated from those who are not crisis-prone. This part was supported.

Hypothesis 3 stated: Husbands and wives will approximate each other in their interpretation of the family's response to the separation when their total adjustment scores are compared and analyzed. This hypothesis also meant that the factors which appeared to be relevant for predicting marital adjustment during the separation as perceived by the husbands would also be relevant for predicting family adjustment to the separation as perceived by the wives. This hypothesis was only partially confirmed. The husbands and wives defined adjustment to the separation differently. However, most of the variables that were significantly related to the separation adjustment for husbands were also important for the wives.

Hypothesis 4 stated: The greater the social participation before the imprisonment the higher will the wives rank on the adjustment to separation scale. This hypothesis was rejected.

Microfilm \$2.70; Xerox \$9.20. 205 pages.

ORIENTATIONS OF SENIOR MEN TOWARD WORK SITUATIONS IN A BUREAUCRATIC STRUCTURE AS RELATED TO SOCIAL CLASS BACKGROUND

(L. C. Card No. Mic 59-2885)

Elliott Grosof, Ph.D. The Pennsylvania State University, 1959

The problem raised by this study concerned the relationship between an individual's position in the social class system and the way in which he perceives different aspects of corporate bureaucratic structure. The individual's position in the social class system was determined by an operational definition of status stiuation based upon Max Weber's analysis of the social class system. This analysis involved the dimensions of style of life and opportunity for life experiences which are associated with an individual's position within an hierarchically ordered social class structure. In this study, the objective indices of an individual's status situation (the independent variable) included his father's occupational class as of fifteen years ago, his father's present occupational class, and his father's level of educational achievement.

The classification based upon these indices yielded six different Status Groups (Status Groups I to VI) which constituted the operational independent variable used throughout this study. The members of these Status Groups were drawn from a sample of 216 male college seniors representing six Colleges of The Pennsylvania State University.

The dependent variables were composed of attitudes towards bureaucratic structure. These variables included recognition variables, aspiration variables, work orientation variables, friendship variables, orientations toward the formal bureaucratic structure, belongingness and togetherness variables.

The technique of analysis consisted of drawing a sample of respondents who were then classified according to their status situation, and of determining the distribution of their responses according to their perception of bureaucratic structure. Where applicable, chi square was used to test the null hypotheses relating the dependent and independent variables. Null hypotheses were rejected at the .05 level of significance.

The hypotheses analyzed in this study indicated that patterns of attitudes toward bureaucratic structure were not statistically associated with the different status situations, vertical social mobility, and modal forms of socialization which were implied by the operational definitions of Status Groups.

Microfilm \$2.00; Xerox \$7.00. 148 pages.

#### WORKERS VOTE: THE POLITICAL BEHAVIOR OF MEN IN THE PRINTING TRADE

(L. C. Card No. Mic 59-2585)

Gene Norman Levine, Ph.D. Columbia University, 1959

This is a study of how printers in New York City voted in the 1952 presidential contest. A stratified, random sample of 434 men was interviewed in winter, 1951-1952; in addition, mail questionnaires were sent to the men the following June and November. The data were originally collected as part of an inquiry into the bases of the unusual democratic system internal to the International Typographical Union (reported as S. Lipset, M. Trow, and J. Coleman, Union Democracy).

Although the printers are socioeconomically homogeneous, they nevertheless show remarkable diversity in their political behavior. In 1952 a little over half the printers voted for Stevenson, a little under half for Eisenhower. Part One asks: What are the bases of this political diversity? During the campaign the men's vote intentions were comparatively unstable. Part Two asks: What accounts

for this instability?

Part One. Religious affiliation was highly correlated with Democratic-Republican choices: Jews voted more Democratic than Catholics who, in turn, voted more Democratic than Protestants. Only Catholic printers involved in the religious community defected from the Democrats. Within each religious group younger printers voted more Democratic than older. Except for Jews, the more generations a man's family has been in the United States the less likely was he to vote Democratic. Within each religious group, self-styled middle-class printers tended to follow the Republican norm of that class only if they are exposed to middle-class values in their social relationships. Self-styled working-class printers voted Democratic whether or not they are exposed to middle-class

values. Nonmobile and downwardly mobile men voted Democratic to the same degree. Liberalism-conservatism was as highly correlated with voted choices as religion, but is itself highly correlated with religion. Religious affiliation for the Catholics and Jews was the stronger determinant, ideology for the Protestants. The ideologically sensitive were more party loyal than the nonsensitive. Printers influenced one another's voting behavior--but only in some settings. Men formally, but not informally, involved in the occupational community tended to vote Democratic regardless of political predisposition. The same held for men who work nights or in small shops (especially both). The Democratic-predisposed are more aggressive and thus influence the others--when they can reach them. Returns from residential election districts reveal a correlation between a man's predisposition and the vote in his neighborhood. Men living in "incompatible" districts did not necessarily take on the political coloration of their neighborhoods. Some, in fact, seem to have voted against neighborhood norms: for example, the Republican-predisposed living in Republican districts were more likely to vote Democratic than those living in Democratic dis-

Part Two. The printers, largely Democratic in 1948, were largely Republican a year before the 1952 election. There was a gradual return to the Democrats by Election Day. Truman-Eisenhower voters were ideologically like Republican constants, but like Democratic constants in their occupational involvement. Polarization between subgroups developed over the campaign, but only the Democratic-predisposed became more homogeneous. Opinions on the Taft-Hartley issue brought vote intentions into line more often than vote intentions brought opinions on the issue into line. Forty per cent had been in both camps at different times during the campaign, a measure of the occupational rate of instability in vote intentions. Printers subject to ideological and environmental cross-pressures as well as the politically interested and the better educated were more unstable than their opposites. The rate of instability was highest in those sections of the trade where men interact the most. Instability in vote intentions may be more closely associated with the person's position in the social structure than with his personal characteristics (e.g., political interest).

Microfilm \$3.95; Xerox \$13.20. 305 pages.

DELINEATION OF RURAL COMMUNITIES
IN THE STATE OF OAXACA, MEXICO

(L. C. Card No. Mic 59-3550)

Benjamin Harrison Luebke, Ph.D.

The University of Florida, 1959

This study is the result of an attempt to test the validity of concepts and methods of community delineation by applying those developed in the United States to conditions in the State of Oaxaca, Mexico. The rural community with a social and territorial structure as delineated by Galpin provided the model for comparison.

Following a discussion of the social and cultural background of the Oaxaca community, fifteen Oaxaca communities selected from five Indian tribal areas of the Sierra Madre, the Mixtec Upland, the Oaxaca Plateau, and the coastal lowlands were delineated. Data were obtained through interviews and direct field observations in these communities from June to October, 1958.

It was found early in the study that only the most basic community concepts and simple techniques of delineation were needed. Interviews at each community center to determine its sphere of influence were essential, but the detailed methods used by Galpin and Sanderson for determining individual membership in communities were not applicable to a society accustomed to group rather than individual activities and to the village pattern of settlement as opposed to the scattered-farmstead pattern. Direct observation of community life compensated to a great extent for semantic difficulties encountered in the interviews.

Delineation was simplified by the homogeneous, undifferentiated, and simple interest pattern which exists in most communities of Oaxaca. Delineation also was facilitated by the tendency of community interests to compound and cumulate into a "bundle" of interests which were especially manifested in such special events as fiestas and market days. The local government of the municipio was found to play an important part in integrating community interests, and itself constitutes a general, all-purpose social institution.

Evidence permitted the preliminary conclusion that in most cases the area of the municipio approximates that of the community. Thus, the municipio, of which there are 571 in Oaxaca, was examined with respect to criteria of the rural social community. Additional evidence based upon delineation of the fifteen communities showed that, in the less accessible folk societies, the area of the community and that of the municipio are more or less coextensive, but that as urbanization and population increase, and the land resources become insufficient, the old patterns of community division and equilibrium tend toward dissolution.

The ejido was examined in the light of community criteria to determine whether or not the area of influence of this agrarian institution coincides with that of the community. It was found that the ejidos studied generally constitute neighborhoods performing only part of the total functions of a community. In one instance, the influence of an ejido was sufficient to dominate the entire municipio and its community composed of several smaller villages and attached ejidos.

Religious, educational, trade, and recreational areas also were examined for the purpose of determining their influence in determining the community area. In single-village communities and municipios, the areas of these several interests usually coincide with the area of the community. In the case of larger trade centers, the areas of trade and recreational interests extend beyond the area of the community. In no case was the trade function of primary importance in determining the community area.

Service programme and survival representational property and programme

Microfilm \$2.35; Xerox \$8.20. 177 pages.

THE IMPACT OF A VILLAGE FACTORY ON A SELECTED AREA OF RURAL LOUISIANA

(L. C. Card No. Mic 59-3082)

Harold Wayne Osborne, Ph.D. Louisiana State University, 1959

Supervisors: Professors Paul H. Price and Alvin L. Bertrand

The President of the United States, in 1954, requested that particular attention be given to the problems peculiar to farmers with low incomes. In this connection, increased attention has focused on a means of raising rural income by the decentralization of industry to provide off-farm employment in low-income rural areas. More concern, however, has been devoted to surveys and substantiations of the problem than to systematic appraisals of practical solutions. The present study is an effort to perform the latter task. It centers on a single factory in a selected low-income area of rural Louisiana and attempts to describe its impact in a triadic focus: upon the workers, upon agriculture, and upon the community.

The study is substantive in design and consists primarily of statistical material. A situational frame of reference is utilized in the study approach. The "situation" is defined as an event—the introduction of industry into a low-income rural area—and the investigation is

focused on the resulting adjustments.

To obtain the desired data, schedules and personal interviews were utilized with two sample groups: (1) a 40 per cent random sample of the plant employees, and (2) a probability area sample of the open-country people living within commuting distance of the factory. The latter group was used to provide a basis for certain comparisons between the plant employees and local non-employees, and to reflect the wider impact of the plant. In the course of the study, 204 plant employees and 302 open-country families were interviewed. The data were coded, verified, and punched on IBM cards. Desired information was obtained through machine runs and tabular analysis.

Two sets of findings stand out:

(1) Rural industry does have a definite economic effect on the laborers employed, and is an effective means of raising rural levels of living. The income of the factory workers was considerably higher than that of the average open-country resident, and the level of living of the plant employees had risen much more, relatively speaking, than that of the respondents in the open-country sample. Females and nonwhite employees, especially, had benefited from their plant employment.

(2) Outside its economic impact, however, rural industry is unlikely to effect much basic change in rural areas. The factory studied had not disturbed the social participation and habits of its employees, nor their leisure time activities. It had made very little change in their agricultural practices, and had not affected community life significantly. Nevertheless, the vast majority of the plant employees and two-thirds of the open-country respondents felt that the factory had "helped" the commu-

nity.

The general conclusion is that while rural industry may be one answer to the economic problems of certain rural areas, it is unlikely to disturb the social values and basic habit-ways of the local people. Be this advantage

or disadvantage, it should be significant to those interested in establishing rural industry in low-income farm areas. Microfilm \$4.20; Xerox \$14.20. 327 pages.

## THE EMERGENCE OF TWO WEST AFRICAN NATIONS: GHANA AND THE IVORY COAST

(L. C. Card No. Mic 59-3139)

Immanuel Maurice Wallerstein, Ph.D. Columbia University, 1959

Systematic European administration of West African territories led to a basic change in the social structure and eventually to the emergence of new nation-states. This process is analyzed in two such nations, Ghana and the Ivory Coast, which had differing colonial rulers.

Within a colonial situation of radical inequality, West Africa saw the growth of cities, the widening of a market economy, the creation of new educated classes, the decline of traditional authorities.

The emergence of classes of people socialized into roles they were not permitted in a colonial situation to fulfill led to demands for equality in the political, economic, and cultural spheres. Nationalism came to be the only acceptable answer to the political demand, which was considered the prerequisite of fulfilling other demands.

World War II hastened the process of social change and made possible the development of a mass nationalist movement, which came into active conflict with the colonial administration. This "time of troubles" (1945-1951) culminated in a compromise between the nationalist movement and the colonial power in both Ghana and the Ivory Coast. This compromise involved the establishment of a transitional dyarchy, which ended in the case of Ghana with independence in 1957.

The process was basically the same in Ghana and the Ivory Coast, despite the different methods and norms of the colonial powers. Developments in both countries grew out of certain fundamental structural changes in the social order occurring within a changing world context, which lent support to the development of anti-colonial movements.

While the objectives of equality were clear in the political sphere, they seemed less clear in other spheres. Ambivalences between Westernization and cultural nationalism, divergencies on economic programs began to appear within the nationalist movement.

The network of voluntary associations that emerged in this process of social change seemed to play a crucial role in the creation of these new nations. Voluntary associations performed three principal functions for the new social structure. They mediated changes in values, socializing new urban residents to role requirements. They provided a basis for centers of countervailing power, at first to the colonial power, later perhaps to the nationalist movement. In this connection, they provided an important training-ground for political skills. Thirdly, they aided the process of national integration by establishing new links across kinship lines.

In the new social structure, education came to be a major indicator of prestige and a major mechanism of upward mobility. With the rise of the nationalist movement, politics began to serve as a second channel of mobility. The two elites -- the intellectuals and the politicians -- conflicted. Traditional chiefs could not compete successfully in the new society but still retained some potential reserve authority. The national hero played a crucial role in the emergence of the nation, and his aura is being protected today against rapid routinization.

Directions of future change are uncertain, in view of the strains caused by the rapidity of the change and the difficulties of institutionalizing parliamentary procedures.

This study includes data drawn from intensive interviews with 204 leaders of voluntary associations in Accra and Abidjan, capitals of the two nations. The study is relevant for students of social change in colonial and newly-independent nations, nationalist movements, voluntary associations, and the theory of democratic institutions.

Microfilm \$4.60; Xerox \$15.40. 360 pages.

## METROPOLITAN MIGRATION IN THE UNITED STATES 1949-1950

(L. C. Card No. Mic 59-3234)

. Walter Bingham Watson, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Douglas G. Marshall

The purpose of this study is to isolate and indicate the relative importance of factors related to metropolitan migration in the United States for the year 1949-50. In, out, net, and gross migration rates for 128 large Standard Metropolitan Areas (SMA's) are analyzed, using the 1950 census data on mobility. Correlation analysis is employed to test several hypotheses, and this analysis indicates that numerous social and economic characteristics of the SMA's are related to the migration rates. More detailed consideration is given the net and gross migration rates by means of multiple-regression and covariance analysis.

The major findings of the study are as follows:

1. Fifty-six of 128 SMA's had net migration losses for 1949-50. This finding suggests that net migration away from SMA's may be more common than some demographers have suspected.

2. Contrary to hypothesis, net and gross migration rates are negatively correlated with level of living measures. However, both rates correlate positively with measures of economic opportunity as distinct from level of

3. Gross migration is high and net migration is positive for trade centers. Gross migration is low and net migration is negative for manufacturing centers. However, both rates correlate positively with the expansion

of manufacturing activity.

4. Net and gross migration rates are related negatively, as hypothesized, to maturity of the SMA as measured by age, size, density, and suburbanization.

5. Net and gross migration rates are greatest in SMA's most isolated from other SMA's.

6. There exist marked regional differences in migration rates as hypothesized. Both net and gross migration rates are low in the Atlantic Metropolitan Belt and Great Lakes-Northeastern Economic Provinces, and both rates are high in the South and West.

7. With only three concepts it is possible to "explain" 81 percent of the variance of gross migration. Beta weights reveal that functional type of SMA, maturity of SMA, and regional location of SMA are each independently important in the explanation.

8. The same three concepts plus economic opportunity (extent of unemployment) "account for" only 49 percent of

the variance of net migration.

SOCIOLOGY

The various analyses provide conclusive evidence that migration rates do vary with social and economic characteristics of SMA's. The factors which best "explain" gross and net migration are functional type of SMA, maturity of SMA, regional location of SMA, and, in addition for net migration, economic opportunity. No single-factor theory yet devised adequately explains migration. Each of the factors mentioned above is independently important, but none alone is sufficient. Even when used simultaneously, these concepts provide an explanation of migration that is only partially complete.

Microfilm \$2.00; Xerox \$5.80. 118 pages.

### SOCIOLOGY, FAMILY

PARENT RECOGNITION OF THE PROBLEMS OF THEIR SECONDARY SCHOOL CHILDREN IN A SELECTED OREGON COMMUNITY

(L. C. Card No. Mic 59-3400)

Keith Andrew Bell, Ed.D. Oregon State College, 1959

Major Professor: Denis Baron

Purpose of Study

The purpose of this study was to find how well a selected sample of parents could identify the problems of their own high school youth. A subsidiary purpose was to determine if some subgroups within the sample could estimate the problems of their teen-agers better than could others.

The Sample

The 433 high school students in the sample were all either freshmen or seniors in a large union high school district near Portland, Oregon. Forty-two percent came from rural homes, 31 percent from the city, and the remainder were from the suburbs, small towns, or villages. The parent group comprised 381 fathers and 427 mothers of these high school adolescents.

The Method of Study

The high school youth indicated their problems by checking the SRA Youth Inventory, Form S. Their parents checked matching inventories, indicating what they felt were their own children's problems. Each parent was scored against the responses of his own adolescent. The significance of the mean parent score and of each individual parent score was determined by comparing it with the score possible by chance, using the .05 level of confidence as the criterion of significance. By the method of analysis

of variance comparisons were made among subgroups of parents to determine if there were significant differences between or among mean scores. The criterion for significance was the .05 level of confidence.

## Findings of the Study

- 1. The mean score of the total parent group is statistically significant, although 20 percent of the parents did not have significant scores.
- 2. The differences between the following subgroups of parents were not statistically significant.
  - a. Fathers versus mothers
  - b. Fathers of daughters versus fathers of sons
  - c. Mothers of sons versus mothers of daughters
  - d. Foster and stepparents versus natural parents
  - e. Parents of seniors versus parents of freshmen
  - f. Urban parents versus rural parents
  - g. Employed mothers versus mothers not employed outside the home
- Sibling position of the adolescent also appeared to make no significant difference on the parents' scores. Parents could predict the problems of oldest, middle, youngest, and only children equally well.
- 4. Parents to whom adolescents indicated they went with their problems had statistically higher scores than did parents to whom adolescents indicated they did not go with their problems.

### Interpretation

Since the city in this study is agricultural in atmosphere, urban and rural differences may tend to be obliterated. Fathers and mothers may have collaborated some when they checked the inventories, thereby reducing the differences between them. To the extent that parents and the adolescents were sincere and cooperative in the study the findings appear to have validity for this community.

Microfilm \$2.00; Xerox \$6.40. 132 pages.

# A STUDY OF COLLEGE STUDENTS' ANTICIPATED ROLE BEHAVIOR IN MARRIAGE

(L. C. Card No. Mic 59-3537)

Clifford John Bodarky, Ed.D. The University of Florida, 1959

#### Statement of the Problem

A survey of the research in the general field indicated that there was a need for understanding of the degree to which unmarried college students anticipated their role behavior in marriage.

The problem was twofold: (1) to evaluate the anticipated role behavior in marriage among unmarried students and (2) to analyze the factors which helped develop these attitudes toward the anticipated role behavior in marriage.

## Methodology

Fifty students who were matriculated at the University of Florida were interviewed. They comprised twenty-five

men and twenty-five women who were not married and had not had a formal course in Marriage and the Family. Their material was produced in a verbatim record from the tape recordings of the interviews. They also completed, in advance of the interviews, a statement of their feelings about marriage. The composition of the group indicated that they were quite representative of the student boy. They were selected quite freely, except for the limitations noted previously.

#### Findings

1. Ninety-six per cent of the male students accepted the role of husband and father and eighty per cent of the female students accepted the role of housewife and mother.

2. Fifty-two per cent of the students wanted a marriage characterized by functional sharing of roles with no sexual dominance. Twenty-eight accepted functional sharing with male orientation.

3. All the students felt that they had acquired their basic feelings about marriage by either accepting their parents' marriage as a positive and helpful one they wanted to duplicate, or by rejecting their parents' marriage as negative and unhelpful.

4. Sixty-four per cent described a positive experience in living with their parents and thirty-six per cent believed the experience had been negative and unhelpful. Eleven of the students came from divorced homes and only two of them related that they had a positive orientation toward marriage.

5. Sixty-six per cent felt that the church had not helped them develop their attitudes toward marriage.

6. Seventy per cent felt that schooling had not helped them develop their attitudes toward marriage.

7. Mass media and discussions with friends did not appear important.

8. Ninety-four per cent felt that they wanted sex to be a shared mutual expression of love in marriage.

9. Seventy per cent believed that religion would be important in their marriage.

10. Sixty-six per cent wished a relationship of sharing with the male lending direction in controlling money.

11. The responsibility for divorce was considered as mutual. The causes most frequently offered were: incompatibility, adultery as a symptom, the fact of adultery, alcoholism, and cruelty.

## Conclusions

- 1. The hypothesis that a considerable distortion of role perception would be found was not supported by these data.
- 2. The hypothesis of a commitment to equal sharing in marriage was strongly supported by these data.
- 3. The home experience emerged as the most important factor in the development of attitudes toward marriage.
- 4. The formal social structures of church and school were not described as having been of significant help in the development of attitudes toward marriage.
- 5 The students were realistic in their appraisal of their anticipated marriage roles and enormously sensitive to the subtle aspects of the relationship.

Microfilm \$2.25; Xerox \$7.80. 170 pages.

SOCIOLOGY, RACE QUESTION

WILLIAM FAULKNER AND THE NEGRO

(L. C. Card No. Mic 59-3557)

William Clark Doster, Ph.D. The University of Florida, 1955

This study examines the prose writings of William Faulkner (1) to analyze his representation of the conduct of Negroes, especially in their relationships with each other and with whites, and (2) to trace and define the unfolding of Faulkner's attitude toward the Negro.

Chapter I presents a brief historical and statistical survey of the Negro in Mississippi as a background for the problems which are inherent in the situations about which Faulkner writes. In this chapter, also, are definitions of "good" and "bad" Negroes and the "mask" of the Negro, terms which clarify certain standards applied to Negro conduct.

In Chapter II, a brief biography relates him and his work to his chosen fictional setting, the imaginary county of Yoknapatawpha and its county seat Jefferson. These communities closely resemble Lafayette County and the town of Oxford in Mississippi. His insight into Negro life and customs is connected with his having had as a child a Negro nurse who resembles the fictional Aunt Cal'line in Soldier's Pay and a Negro boy playmate who resembles the fictional Ringo in The Unyanquished. The moments of Negro history in Mississippi which Faulkner selects for particular emphasis are shown to be related to slavery, reconstruction, and the dislocations resulting from a Negro soldier's experiences in World War I. In this chapter, also, is a description of the various tensions which exist between the various castes of the whites and the Negroes.

Chapter III presents and discusses, in the order of the publication of the novels, every significant Negro character and every significant episode involving Negro-white relationships.

Chapter IV analyzes the evidence presented in Chapter III to demonstrate Faulkner's progressive stages in stating with greater explicitness his belief that the Negro should be treated as a human being. Soldier's Pay shows Faulkner's sympathy for the Negro and his insight into their way of life. Sartoris presents the changing patterns of Negro-white relationships after World War I and how these changes affected both whites and Negroes. The Sound and the Fury illustrates a favorite Faulkner theme that the Negro can endure virtually anything. Light in August shows how revenge from a Negro against whites fails and erupts in violence which hurts both Negroes and whites. Absalom, Absalom! points up one possible solution to the Negro problem in the South: amalgamation of the races. Go Down, Moses shows that the South is guilty of shame in its treatment of the Negro and points out how one man tried to atone for that guilt and shame. Intruder in the Dust describes how a Southern boy, by violating the white code, could save a Negro from being lynched.

The concluding Chapter shows that in certain non-fiction writings, especially in the speech accepting the Nobel Award in 1950 and in four open letters to a newspaper in March and April, 1955, the attitude defined for the first time in this study of the fiction receives confirmation. William Faulkner today, in his fiction and in his

public utterances, is a proponent of the integration of the Negro and white races in the schools of Mississippi. He has apparently made no statements related to other problems involved in desegregation except the general one that the Negro should be treated as a human being.

Microfilm \$2.55; Xerox \$8.80. 194 pages.

SOCIOLOGY, SOCIALISM, COMMUNISM, ANARCHISM

LABOR PRODUCTIVITY IN BASIC INDUSTRIES OF THE USSR, 1928 TO 1955, AS MEASURED FROM PRODUCTION COSTS

(L. C. Card No. Mic 59-3137)

Edgar Lynn Turgeon, Ph.D. Columbia University, 1959

This study measures Soviet labor productivity trends reflected in unit labor cost changes from 1928-55. Changes in money unit labor costs are deflated by relatives measuring money wage movements to obtain real unit labor costs -- the reciprocals of changes in labor productivity. Nine basic industries are considered: coal, peat, power, oil, ferrous and non-ferrous metals, chemicals, wood products, and cement.

Changes in unit labor costs are derived from the following data: (i) total production costs for homogeneous products from nine basic industries in various years; and (ii) corresponding breakdowns of costs, specifically the percentages accounted for by direct and indirect labor. Since the unit labor costs include the payments to all workers and employees, the wage deflator should also be "all-inclusive."

Calculations of all-inclusive wage changes for workers, engineer-technicians, and white-collared employees are possible for 1928-40. Although the series of relatives for workers' and employees' wages rises somewhat faster than the wage relatives for workers alone in the early thirties, by 1940 there is no significant difference between the two sets of relatives. This is because the growing relative importance of engineer-technicians is offset by greater increases in workers' as compared with engineertechnicians' wages. Since 1940, the percentage of the labor force accounted for by engineer-technicians has remained comparatively unchanged, although wage increases for engineer-technicians continued to lag relative to workers' wage changes. The gap between the two wage series may have closed by 1955; thus, the use of relatives for changes in workers' wages only as deflators of unit labor cost changes in the postwar period seems jus-

The calculated overall increases in output per worker are as follows: coal - 2.5 times (allowing for quality deterioration); peat - 4.5; power - 8.1; oil - 2.1; ferrous metals - 6.6; nonferrous metals - 2.7; chemicals - 4.3; logging - unchanged; cellulose-paper - 3.9; and cement-6.6 times. Because of inadequacies in the underlying data, the results for peat, nonferrous metals, and chemicals are believed to be less reliable than the others.

The overall increase in labor productivity for basic industries generally, excluding machine-building, is calculated in two ways. According to one method, the indexes of overall change in production cost for basic industries as a whole are assumed to be representative of the changes in unit labor costs and are deflated by the corresponding change in wages. In the alternative calculation, the individual increases in productivity as calculated for the nine industries are aggregated using a labor force weighting system. The results indicate an overall increase in labor productivity of about 3.3 times with a possible error of 10 per cent either way. It seems certain that the increases in machine-building have been considerably greater than this overall increase for basic industries, while the gains in consumer goods industries have been smaller. It is believed that the former may outweigh the latter so that the overall increase in non-agricultural labor productivity may exceed 3.3 times.

Among the industries studied, there has been no pos-

itive correlation between growth in labor productivity and increases in money wages. The industries where wages increased the most -- coal and logging -- were far below average in improving productivity. Four industries -- cement, machine-building, chemicals and power stations -- all showed below average increases in wages, although greater-than-average gains in productivity were being achieved.

In some sectors of industry, gains in labor productivity have been roughly matched by rising wages so that money unit labor costs here may be at their 1928 level. These sectors include machine-building generally, aluminum, sulphuric acid, and the Magnitogorsk and Kuznetsk metallurgical combines. Other sectors of basic industries increased wages much faster than labor productivity and rising unit labor costs were therefore experienced here. These rising unit labor costs were the basis of the cost-price inflation in basic industries from 1930-47.

Microfilm \$10.20; Xerox \$36.40. 808 pages.

#### SPEECH-THEATER

AN EXPERIMENTAL INVESTIGATION OF THE COMPREHENSION OF PROSE MATERIALS WHEN READ SILENTLY AND WHEN READ ALOUD

(L. C. Card No. Mic 59-3061)

Raymond E. Collins, Ph.D. University of Southern California, 1959

Chairman: Professor McCoard

The general purpose of this study was to investigate possible differences in amount of comprehension for a given period of time between the oral reading and silent reading of prose materials. The problems of this study were to determine: (1) When read silently and when read aloud, does either manner of reading each of the seven selections of prose material produce significantly higher comprehension scores at any of seven levels of difficulty? and (2) When read silently and when read aloud, does either manner of reading the selections produce significantly higher comprehension scores when the scores for all seven levels are combined?

The experiment was developed in four main stages. First, materials devised by Cartier, Goodman-Malamuth, and Harwood were selected. Their materials consisted of seven short stories which were rated according to the Flesch reading ease scores representing seven levels of difficulty ranging from "very easy" to "very difficult." Each story was followed by a test which consisted of fifteen questions on information in the story. Second, of the total of sixty subjects selected for the experiment, thirty performed the oral experiment and thirty performed the silent one. The subjects were freshman students at San Jose Junior College. The oral readers were considered to be matched with the silent readers in their distribution of age, sex, raw scores on Schools and College Aptitude Test and Stanford Achievement Test. Third, each subject of the oral reading group was tested individually, and each subject of the silent reading group was tested individually. Fourth, in manipulating the data gathered by the foregoing procedures, the principal statistical technique was the significance of mean differences.

Conclusions. When seven prose selections representing seven levels of reading ease were read silently by one group and orally by another group, and comprehension tests were taken, the following mean differences between test scores were found: (1) On the "very easy" selection the scores by oral readers were significantly higher, (2) on the "easy" selection the scores by oral readers were significantly higher, (3) on the "fairly easy" selection the scores by oral readers were insignificantly higher, (4) on the "standard" selection the scores by oral readers were insignificantly higher, (5) on the "fairly difficult" selection the scores by oral readers were very significantly higher, (6) on the "difficult" selection the scores by oral readers were insignificantly higher, and (7) on the "very difficult" selection the scores by oral readers were insignificantly higher.

When the scores on all seven comprehension tests were combined, and the two methods of reading (orally and silently) were compared, the following mean difference between total test scores was found: the total score by oral readers was very significantly higher.

Microfilm \$2.00; Xerox \$6.20. 128 pages.

AN ANALYTICAL STUDY OF THE DRAMATIC CRITICISM OF JOSEPH WOOD KRUTCH AS PUBLISHED IN THE NATION, 1924-1952

(L. C. Card No. Mic 59-3063)

Gordon C. Green, Ph.D. University of Southern California, 1959

Chairman: Professor Butler

This study was made in an attempt to determine the significant attitudes and opinions that Joseph Wood Krutch held regarding the Broadway theater during the 28-year period that he was drama critic for The Nation. The purpose of the work was (1) to offer an insight into that period of the American stage when it was transformed from a relatively insignificant and second-rate theater to one of the first theaters in the world, and to see how the criticism of Krutch reflected that change, (2) to find out what the critic's criteria or standards of judgment were concerning such important elements of the theater as acting and playwriting, (3) to trace any attitudes or prejudices pertaining to various phases of the theater which Krutch may have held over the years and which may have reappeared noticeably in his drama column, and (4) to point out any exceptions or changes in his general theories and convictions.

The criticism of Krutch recorded the development of the American musical from a period of insignificance to one of world fame. Although Krutch reflected the taste of the 1920's by generally preferring the plotless revue over the more complex musical comedy, he was able to recognize the superiority of the more intelligent book in Sweet Adeline (1929), a Hammerstein musical. He was also able to detect the increasing refinement and good taste of the revues of the 1930's which he attributed to the influence of the night club entertainer. The critic's prejudice against more refined and sophisticated musicals, however, continued into the early 1940's, even though he acknowledged the excellence of Lady in the Dark (1941). From the time of Oklahoma! (1943), he conceded that the more mature musical comedy form was superior to the earlier orgiastic revue. The American public, as well as Krutch, changed their predilection for the revue in favor of the musical comedy.

Krutch preferred a nonrealistic style of acting, particularly in the realm of comedy. He explained it as that imperceptible wink to the audience which never allowed it to forget that the actor was impersonating. Krutch considered that theater conditions of Broadway tended to perpetuate the realistic style of acting in which the actor was type-cast to play himself over and over again. The critic felt that the atmosphere developed by repertory groups in which the actor was trained to play many different kinds of roles was more desirable. Only when an actor could create something original in a traditional or classical role did Krutch judge that he had met the touchstone of superior acting.

Krutch was opposed to the following types of plays: the thesis or propaganda play, which was especially popular in the 1930's; the "well-made" play; the play which copied the formula of a former success; the play which was adapted from other media; the topical play inspired by newspaper headlines; the biographical play; and the play whose author was uncertain of how he felt about his characters and their fates.

In the 1920's Krutch was convinced that plays could not be satisfactorily adapted from novels. In the 1930's he began to make a few exceptions; and by the 1940's, though he regretted the theater's increasing dependence upon adaptations, he abandoned the position that a play could not be satisfactorily adapted from a novel.

Microfilm \$4.25; Xerox \$14.20. 330 pages.

THE AMERICAN MUSICAL STAGE BEFORE 1800

(L. C. Card No. Mic 59-3118)

Julian Mates, Ph.D. Columbia University, 1959

This work has three purposes. First, it explores an area of American culture in which almost no previous work has been done. Second, it sets back the date for the first American musical comedy more than seventy years. Third, it suggests that today's American musicals, far from being recent innovations, are a heritage from the eighteenth century.

Only two books deal with the history of America's musical comedy, David Ewen's Complete Book of the American Musical Theatre and Cecil Smith's Musical Comedy in America; both begin with The Black Crook, in 1867. Both ignore, for reasons neither gives, the history of the musical in America up to that date. Only Oscar G. Sonneck's Early Opera in America deals with some aspects of the eighteenth-century repertory, but with little attempt to see musicals in their relationship to the theatre as a whole.

A few books and articles have handled different facets of America's early drama. Yet each has missed a significant fact: America's early theatres were essentially lyric theatres. In eighteenth-century England, a new stress on musical productions was gradually absorbed into other dramatic traditions. In America, no earlier dramatic forms existed, and the musical stage became our only theatre tradition. No one work has as yet attempted to put together all the elements which made up America's early musical stage, and yet it is possible that only by looking at the theatre in its entirety -- the entertainments related to the stage, the theatres, the theatre orchestras, the companies, the repertory, the librettists and composers, the critical milieu -- can America's early drama be seen for what it was: the beginning of a tradition of musical drama. This book, then, attempts to re-evaluate the early American theatre.

Such related entertainments as circuses and concerts put musicals on the stage and used the best singers and actors of the day. The theatre orchestras used fine musicians and reflected all the changes in the form and conception of the orchestra then going on in Europe. The theatres were comparable in every way to those in England and attracted every class of society. The acting companies were composed of native-born Americans and the best English and French actors, and all members were expected to act, to sing, and to dance. Over half of the repertory was made up of musicals, and even the non-musical half was frequently riddled with songs and

Today's musical stage flourishes. Musicals use extensively all theatrical conventions and are currently

America's most vital stage form. Yet conventions are not created for particular productions -- they evolve slowly, and the conventions which fill today's musicals with vitality began their movement in time on the stages of America in the eighteenth century.

Microfilm \$4.55; Xerox \$15.40. 356 pages.

THE DEBATE IN CONGRESS ON THE KANSAS-NEBRASKA BILL, A STUDY IN PERSUASION

(L. C. Card No. Mic 59-3211)

Donald Orrin Olson, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Henry L. Ewbank

The major problem in this study was to find the various means of persuasion used in the debate in Congress on the Kansas-Nebraska Bill. More specifically the following questions were answered: 1. Who was being persuaded? 2. Of what were they being persuaded? 3. What means of persuasion were used? 4. Did any other influences develop that could be used to pass or kill a bill?

The primary data for the thesis were found in the Congressional Globe and the Appendix to the Congressional Globe for 1854 which recorded the one hundred and thirty-seven speeches of the debate, in newspapers of that period representing various sections of the country and various viewpoints on this debate, and in Senator Douglas's personal papers.

For purposes of this study, the following definition of persuasion was used: Persuasion is any oral or written method of influencing a listerner's or reader's thoughts and actions. The word "reader" was included in this definition because much of the persuasion was carried on by newspapers and petitions and many of the speeches were published and read by constituents at home.

After analyzing the data, the following answers were found to the major questions of the study:

The many changes in the bill, the newspaper attacks on the advocates of the bill, and the many petitions from legislatures and special interest groups were attempts to influence the votes of the legislators. The repetitiousness of the content material within the speeches and the numerous apologies that were made for even giving them, indicated that many of the speeches were directed at the voting public.

Congressmen were urged to pass or kill the bill and to forgive the speaker for giving the speech. The voters were persuaded that their Congressmen were on the job and were looking after the interests of their constituents. The repeated detailed histories of slavery and the Missouri Compromise tended to impress the voters as to the knowledge possessed by their Congressmen.

There were many evidences of ethical and emotional proofs. Arguments were analyzed as to relevancy and development. The refutation of the opposition was considered and the strength of the argument as evaluated. The bill, the appeal to witnesses, the coercion by the Democratic party, and the petitions were examples of inartistic proofs.

The following influences developed outside of the debate

to aid in passing or killing the bill. The changes in the bill made it acceptable to Southerners. The stalling tactics in both houses could have prevented final consideration of the bill. Parliamentary strategy was used by both the advocates and the opposition. Newspapers and petitions exerted a strong influence. All of these were important, but party pressure was the deciding factor in the passage of the bill.

Microfilm \$3.40; Xerox \$11.60. 261 pages.

#### REVENGE IN RESTORATION TRAGEDY

(L. C. Card No. Mic 59-3303)

Hugh Winston Park, Ph.D. University of Utah, 1959

Chairman: Dr. C. Lowell Lees

This thesis is a study of twenty-seven of seventy-six Restoration tragedies written between 1656 and 1692 by William D'Avenant, John Dryden, Nathaniel Lee, and Thomas Otway. The dates are determined by D'Avenant's first Restoration tragedy, and Dryden's last. The purpose in examining these plays was to determine whether the tradition of Elizabethan revenge tragedy was continued during the Restoration. If revenge tragedies were no longer written, the second purpose was to determine whether revenge themes were utilized, and last, if they were, how.

Restoration tragedy may be divided into two types. The first, written from 1656 to 1677, was the heroic tragedy, which exhibited the ideal hero and heroine, was filled with the spectacular appurtenances of its kind, and invariably ended happily. The second type, written from 1675 to 1692, was the sentimental tragedy, which tended to withdraw from great affairs of state, emphasized personal problems, principally those of love and marriage, and converted action into introspection and discussion.

It is possible to conclude that revenge themes were widely used during the Restoration, especially in the heroic tragedy, but, with the exception of Lee's <u>Caesar Borgia</u>, no longer as the main theme of tragedy. Although revenge found popular use, the revenge tragedy as a type did not, for heroic tragedy was escapist in nature, and revenge as a theme was never permitted to supercede the "heroic" aspects which made it escapist.

At the same time, heroic tragedy was vigorously romantic and revenge was freely utilized as a manifestation of optimism and affirmation. Hero-revengers could accomplish miracles, and villain-revengers would dare anything. The morality of their revenges was never questioned as those of Elizabethan heroes' had been, for both hero and villain enacted it, the hero without being punished. The hero of sentimental tragedy failed to revenge because of his weakness, not because he considered revenge morally wrong. Characters were not punished for enacting revenges, but for the wrong motives for their revenges. The villain's motives were punishable and he usually died for them, but revenge became an acceptable mark of the hero, for his motives were good.

It would appear that widespread pessimism in England beginning between the years 1675-1677 influenced the drama by converting the positive heroic tragedy into

negative, sentimental tragedy. Revenge began to wane from this time.

The Restoration period began with the static and simply designed dramas by D'Avenant in which revenge was little used because of strict codes of honor which rigidly bound the hero. The period ended with static and simply designed drama in which the hero could not act because his code of honor had completely collapsed. Between these extremes was written a complex and energetic tragedy whose qualities in large measure were the result of a free use of revenge. Restoration tragedy completed a full circle, and the growth and decline of revenge in it helps to illustrate the sort of decay which took place.

COMPARISONS OF VOICE BETWEEN YOUNG COLLEGE WOMEN AND THEIR MOTHERS

Microfilm \$3.00; Xerox \$10.20. 230 pages.

(L. C. Card No. Mic 59-3129)

Hannah Holzman Scholl, Ph.D. Columbia University, 1959

The purpose of the study was to investigate the nature of the vocal differences existing between post-adolescent and middle-aged women.

Tape recordings were made of the reading and speaking voices of thirty subjects--fifteen daughters ranging in age from eighteen to twenty-eight and their mothers ranging in age from forty-one to sixty--who were students or graduates of Hunter College. The recordings were randomized to form combinations of unrelated young and older women, in addition to the daughter-mother pairs, and to determine the position of each subject within a pair and the sequence of presentation of pairs for rating. For each of the thirty women, four judges independently estimated the age-group to which she belonged and evaluated (1) the quality of seven voice and voice production traits and of overall voice production, (2) the "amount" of four of the voice and voice production traits, and (3) the presence or absence of twenty-six voice production characteristics (faults). The judges also estimated relationship and appraised the differences, within fifteen pairs of daughters and their mothers and within twenty-six pairs of young and older women, in (1) quality of the seven voice traits and of overall voice production and (2) "amount" of four of the voice traits.

Reliability of the judges was estimated by correlation for ratings of voice traits and general estimates; extent of agreement among the judges was expressed in terms of proportions for ratings of voice characteristics. Except for four ratings, estimated reliabilities ranged from .60 to .95. Average proportions of agreement for ratings of voice characteristics ranged from .65 to .98.

All ratings were converted into scores which were tested statistically for differences between daughters and their mothers and between unrelated young and older women. The analyses resulted in the following findings:

 The judgments, based on recorded voices, of actual relationship between daughter and mother and of lack of relationship between a random young and a random older woman did not differ from chance.

- 2. Without exception, each subject was judged correctly to be daughter or mother, solely on the basis of her recorded voice.
- 3. There were no significant differences between daughters and their mothers in quality of overall voice production or of any of the rated voice traits: volume, pitch, voice quality, rate, phrasing, flow of language, and intonation and inflection.
- 4. Among the appraisals of the twenty-six voice characteristics, significant differences were found between daughters and their mothers in reading aloud and speaking, where mothers were judged more throaty and "squeezing" in voice quality than were their daughters. In reading only, mothers showed less variation in rate than did their daughters, while in speaking, mothers were less breathy but more tense in voice quality and less correct in phrasing than were their daughters.
- 5. Of all the differences found between daughters and their mothers in "amount" of volume, pitch, rate, and phrase-length, the difference in pitch was significant in reading aloud and in speaking, always lower in the voices of mothers than in the voices of daughters. In addition, mothers were significantly slower in rate while reading aloud than were their daughters.
- Among the voice items evaluated for both related and unrelated pairs, wherever daughters and their mothers differed significantly, unrelated young and older women also differed significantly.

It was concluded, therefore, that (1) more vocal homogeneity existed within each age-group than between daughters and their own mothers, (2) when the age-groups differed, they differed in kind, not in judged quality, and (3) if the differences reflect effects of aging, from post-adolescence to middle-age, the voices of women become lower in pitch and more throaty and "squeezing" in voice quality; they change, but they do not deteriorate.

Microfilm \$2.00; Xerox \$5.40. 109 pages.

DISPLACEMENT OF THE PHARYNGEAL PORTION
OF THE TONGUE AND OF THE HYOID AND
LARYNX IN DEGLUTITION, PHONATION
AND POSTURAL CHANGE

(L. C. Card No. Mic 59-3300)

Ralph LaMar Shelton, Jr., Ph.D. University of Utah, 1959

Chairman: Boyd V. Sheets, Ph.D.

Displacement of the pharyngeal portion of the tongue and of the hyoid and larynx during swallow, phonation and postural changes in five men and five women of college age was observed by motion picture and still radiography. Radiographs were also used to determine the rest position of the hyoid and larynx in these adult subjects and in nine children, five girls and four boys.

In the normal adult subjects, cinefluorography showed

swallow to be divided into three phases, each of which was defined by the direction of hyoid displacement. Movement of the tongue-hyoid-larynx column was generally consistent among the subjects as they swallowed in either the upright or the supine position. However, no consistent phonation pattern of movement was found for the sound [m] as produced in either regular or falsetto voice.

Still radiographs of the adult and child subjects at rest revealed considerable variability in the position of the tongue-hyoid-larynx column components. One structure of a given subject might differ from the relative position of other structures under consideration in the same subject. Structures of females were generally located more cephalad than those of males, and the adult structures reached lower vertebral levels than did those of the children. Consistency in repeat radiography of a given pose and in making measures and tracings from radiographs was determined to be adequate.

Still radiographs were taken of each subject in four groups of activities, and eleven measurements were made from each radiograph. Rank order correlations were computed to determine the presence of direct linear relationships among extent of displacement of the mandible, hyoid, third cervical vertebra and laryngeal ventricle. A relationship was found most frequently between the hyoid and laryngeal ventricle. Other parts of the experimental procedure indicated that the hyoid and larynx approximated in neck flexion and mouth opening activities and separated in neck extension activities. These also approximated in phonation and in falsetto phonation. It was found that the hyoid and third cervical vertebra either separated or did not significantly change relationship in each of the static activities. The most consistent inter-subject patterns of hyoid displacement were found in relaxed neck extension, neck extension against resistance, mouth open widely and mouth open widely against resistance. No consistent difference was found for hyoid displacement in similar relaxed and active poses.

It was concluded that performance of deglutition is useful to the speech pathologist and others as an indication of motor performance in the pharyngeal area, that the study procedure described is worthy of further utilization in investigation of pharynx function and that the concept of a unified tongue-hyoid-larynx column is useful and perhaps essential to understanding of pharynx myology. The limits of normal pharynx function appear to be wide.

Microfilm \$2.80; Xerox \$9.60. 215 pages.

A STUDY OF THE PROFESSIONAL CRITICISM OF BROADCASTING IN THE UNITED STATES 1920-1955

(L. C. Card No. Mic 59-3227)

Ralph Lewis Smith, Ph.D. The University of Wisconsin, 1959

Supervisor: Assistant Professor Jerry C. McNeely

This historical-descriptive study examines the efforts of writers who have surveyed the first thirty-five years of activity in American radio and television with more regularity and probably with greater understanding than most of broadcasting's detractors or apologists. It

attempts to fill a gap in the written history of the media, to explore the fitful progress of a new branch of professional criticism, and to indicate values such criticism has for assisting the art and the industry of broadcasting to fulfill its public obligations, and for assisting the public to evaluate broadcasting.

Selecting the critics whose writings comprise the foundation of the study was accomplished by considering qualities and functions of traditional art critics and of journalistic theater and film critics, and by perusing periodic issues of over seventy metropolitan newspapers and national magazines of general circulation. Eliminated from consideration were publications of the entertainment industry, academic journals, and "fan" magazines. The fact that most broadcasting columnists can be classified as reporter-press agents rather than as thoughtful evaluaters permitted a valid concentration on sixteen writers who have regularly contributed informed, sensitive opinions in the hope that potentials they envisioned for broadcasting would eventually materialize. A chronological listing of these critics and their publications follows:

Late Twenties
John Wallace, Radio Broadcast

**Early Thirties** 

Leslie Allen, Christian Science Monitor Cyrus Fisher, Forum Ring Lardner, New Yorker

Forties and Fifties

John Hutchens, Jack Gould, New York Times
Jack Cluett, Woman's Day
John Crosby, Herald Tribune (New York)
Albert Williams, Saturday Review of Literature
Saul Carson, New Republic
Philip Hamburger, New Yorker
Robert Lewis Shayon, Goodman Ace, Gilbert Seldes,
Saturday Review
Harriett Van Horne, Theater Arts
Marya Mannes, Reporter

Data collected from an extensive review of the critics' books and columns, from interviews with ten critics and correspondence with others, and from many other sources in the literature on broadcasting has been analyzed in an effort to provide answers to the following questions:

- 1. Who are the critics? When did they write? What are their procedures and problems? What is their function?
- 2. What are the critics' opinions about major broadcast forms? (drama, games and light entertainment, music, news, discussion and talks programs, documentaries)
- 3. What have the critics said about three persistent problems in American broadcasting: educational programing, advertising, various systems of operation?
- 4. What has been the response to the critics, and what suggestions have been made for strengthening criticism?

These writers have reached only partial accord about criteria for evaluating media dedicated to mass entertainment, information, and advertising, and they have reached only tentative conclusions about the socioeconomic implications of broadcasting. But, it has been possible to

abstract from the critics' opinions six major values deemed significant for the improvement of broadcasting:

(1) honesty in the content and production of programs and commercials, (2) variety in programing (particularly by adding more of the serious and the satiric) and in operational systems (educational and toll channels), (3) maintenance of human dignity particularly violated in audience participation programs, (4) excellence in writing and presentation, (5) continued cultivation of the art of relaxed informality pertinent to talks programs and commercials, (6) further development of a sense of responsibility in the industry, the public, and the government looking toward a general maturation of programing.

Scant evidence as to the influence of criticism (and here is a fruitful area for research) explains the cautious claims of the critics. They advocate, however, strengthening their area by training children in criticism, by encouraging more journalistic critics, and by broadcasting programs of criticism.

Microfilm \$6.65; Xerox \$23.00. 521 pages.

## THE PROBLEM OF STUTTERING IN CERTAIN NORTH AMERICAN INDIAN SOCIETIES

(L. C. Card No. Mic 59-3821)

Joseph L. Stewart, Ph.D. State University of Iowa, 1959

Co-Chairmen: Professor Wendell Johnson Professor David B. Stout

The influence of culture in the determination and perpetuation of the problem of stuttering has been an item of conjecture for many years. Recent publications revived this interest in the existence or absence of the problem in North American Indian cultures.

In the present study the Cowichan Indians of Vancouver Island, a "stuttering group," were compared with the Ute Indians of Utah, a "nonstuttering group," on variables in child training which may accompany the presence or absence of the problem of stuttering. Thirty households in each society were interviewed through an informant about the socialization of a child in the family on dimensions of nursing and feeding, toilet training, sexual socialization, dependence, aggression, and speech and language development. The development of the child was questioned from the pre-natal period to his level of attainment at the time of the interview.

Three other groups on Vancouver Island were also contacted in order to obtain an estimate of their incidence of speech problems.

The items on which differences between the Ute and Cowichans were found to be statistically significant were: pre-natal sex preferences, initial nursing indulgence, tolerance of crying, severity of toilet training, initial attention, amount, duration, and gradualness of reduction of body contact with the child, standards and conformity to standards of speech fluency and language acquisition, and severity and frequency of punishment. All these differences favored the Ute as the more tolerant in allowing the child to progress at his own rate.

The languages of the groups were investigated in the

belief that linguistic recognition of what is implied by use of the term "stuttering" would tend to cause users of the language to look for any behavior that might be considered deviant and anticipate its appearance.

The roles of reduplication and diminution in the languages appear to reflect the extent to which the peoples in each group are aware of and tolerant of the normal repetitions and hesitations in the child's speech. The Cowichan group do not seem to expect reduplication and repetition in the child's speech, while the Ute recognize this tendency and encourage its development. It is hypothesized that this difference might have further encouraged the development of the problem of stuttering in the Cowichan society.

The hypothesis that cultural factors exist which tend to foster the development of the problem of stuttering seems tenable from these conclusions:

- 1. The incidence of the problem of stuttering on Vancouver Island appears to have declined with the destruction of the native Indian culture.
- 2. Native methods of child training which still exist among the Cowichans reflect the extent to which growth as a dynamic process is acknowledged, with this group being the more demanding of their children.
- 3. Differences between the languages reflect and determine the parental reaction to the process of growth and readiness for socialization.
- 4. The diagnostic use of the term "stuttering" seems, in several instances, to have exerted a more direct influence upon the individual using the term than his own objective observations.
- 5. It is hypothesized that not only the problem of stuttering itself, but also the form it may take, are culturallydetermined and related to the acceptable hesitation forms in the language.

Microfilm \$3.35; Xerox \$11.40. 259 pages.

## HENRY HEAD: HIS CONTRIBUTION TO THE STUDY OF APHASIA

(L. C. Card No. Mic 59-3134)

Alice Virginia Stone, Ph.D. Columbia University, 1959

Physiologist, neurologist, psychologist, and physician, Henry Head (1861-1940) began his study of aphasia in 1886 and for the next forty years concerned himself with the problems of aphasia and kindred disorders of speech in patients who had suffered cerebral lesions. World War I gave impetus to his work, and from his experiences with casualties from this war and with civilian patients, he gradually evolved his theories of aphasia and his procedures for dealing with aphasics.

Centuries before Head started his work man began to try to understand the function and dysfunction of the brain. One of the forms of dysfunction of the brain, aphasia, interested many investigators before Head's time. Head himself was dissatisfied with the work previously done in aphasia and with that of his contemporaries in this area. With one exception, he was apparently not influenced by others in the field of aphasia. That one exception was John Hughlings Jackson.

To Jackson, Head seems to have been indebted, to a

limited extent, for concepts regarding certain aspects of cerebral localization and for those regarding such results of a brain lesion as relative loss of power, imperception, disturbance of voluntary speech, damage to internal speech, and the presence or absence of mental images. In turn, Jackson's work in aphasia might have gone unrecognized had it not been for Head. Head reviewed Jackson's writings on aphasia and republished Jackson's long forgotten papers on this subject (1915). A summary of Jackson's views also appeared in Aphasia and Kindred Disorders of Speech (1926), Head's major publication.

In Aphasia and Kindred Disorders of Speech Head incorporated the results of his forty years of study and research. In this publication he included the historical background of the study of aphasia and then wrote a comprehensive account of his own original research. He described and illustrated his systematic tests, his methods of conducting an examination, his organization of case reports, and his classification of types of disorders. He set forth in detail concepts regarding individual differences; the effect of brain damage on the whole person; the effect of etiology on prognosis; mind, memory, thinking, and intelligence; recovery; regression; variability of response; the attitude and awareness of the patient and other aspects

of response; speech and language; cerebral localization; the anatomical site of lesions and defects; and vigilance.

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An examination of the literature on aphasia in the United States up to and including 1956 revealed a varying pattern of adaptation or use of Head's ideas. Speech pathologists and writers in related fields have drawn information from Head's publications regarding persons of importance in the history of aphasia. They have referred to Head's work or have used, to a limited extent, material from Head's publications regarding tests, methods of conducting an examination, organization of case reports, classification of types of disorders, and other concepts of aphasia. No writer, however, has studied Head's work in a comprehensive fashion.

The present writer believes that Head's contemporaries and later writers in the field of aphasia, knowingly or unknowingly, owe much to Head. This writer also believes that Head's work in aphasia is still worthy of examination as a background for knowledge of research in aphasia, as a source for ideas applicable even now to the subject of aphasia, and as a basis from which further study concerned with language rehabilitation of aphasics and other aspects of aphasia might be directed.

Microfilm \$2.50; Xerox \$8.80. 192 pages.

#### ZOOLOGY

THE PHALLIC COMPLEX IN THE OEDIPODINAE (ORTHOPTERA; ACRIDIDAE)

(L. C. Card No. Mic 59-3370)

Andrew Hales Barnum, Ph.D. Iowa State College, 1959

Supervisor: H. H. Knight

This study was an evaluation of the male copulatory structure with reference to variation and a determination of the importance of the phallus in the classification of the genera and species of the subfamily Oedipodinae. The investigation was based on a study of approximately 760 specimens representing 123 species and subspecies of 45 genera of Oedipodinae and other Acrididae from North, Central, and South America. Descriptions of the epiphallus and the valves of the aedeagus were given for 36 genera and 113 species and subspecies of Oedipodinae. In addition, 464 original drawings, grouped into 182 figures, were presented.

The extent of the research was dependent upon available specimens and no attempt was made to make this a world-wide study. Three monotypic North American genera, restricted in distribution, were not available for examination.

Whenever possible, an examination of more than one specimen was made of each species. If the specimens were available, a large series collected at the same time was examined to study the range of variation. In addition, specimens collected in different years from the same locality were examined to determine any variation which might occur in populations as a result of time. Finally,

specimens of a species distributed over an extended range were studied from widely separated localities and from different habitats.

The generalized type of the phallic complex for the subfamily was figured by a representative species (Conozoa carinata Rehn).

As a result of this study, 39 genera are included in the North American Oedipodinae. Two genera, heretofore considered to be oedipodine (Cibolacris and Xeracris and the species as now recognized in these genera), were transferred to the Truxalinae on the basis of their external characters and the structures of the phallic complex. Synonymy and subspeciation were suggested, but definite assignment is dependent upon a more extensive study. A revision of some genera is necessary before the number of species can be defined adequately.

With few exceptions the phallic complex, especially the epiphallus, and the shapes and relationships of the valves of the cingulum and the apical valves of the penis are not subject to variation to any great degree as are most external characters. When this variation does occur it is found in a species group complex distributed over a large range and in different ecological situations.

The epiphallus and aedeagus are sufficiently important as taxonomic criteria that it is suggested that authors describing species or genera include drawings and discussions of these structures along with the usual external characters. Microfilm \$2.90; Xerox \$10.00. 224 pages.

TAGGING EXPERIMENTS IN THE KODIAK ISLAND AREA WITH REFERENCE TO THE ESTIMATION OF SALMON (Oncorhynchus) POPULATIONS

(L. C. Card No. Mic 59-3314)

Donald Edward Bevan, Ph.D. University of Washington, 1959

Chairman: William F. Thompson

As a part of research on the life history of the red salmon (Oncorhynchus nerka) of Kodiak Island, tagging experiments were conducted to determine the migration patterns and to obtain estimates of the size of the populations. Over 11,000 red salmon were tagged during two years of field study. About 45 per cent of the tagged fish were recovered.

The experiments demonstrated that the majority of the fish were bound for spawning grounds at Karluk Lake. There was little interchange of fish between the northwest coast of the Kodiak Islands and nearby areas.

An experiment with double tags indicated that the rate

of shedding of tags was about ten per cent.

Tags were recovered from a wide range of recovery locations indicating that the tags were mixed within the untagged population. Evidence from opposed migrations between two tagging locations and from tags recaptured more than cace indicated that the fish wander through the fishery rather than migrate directly to the spawning streams.

An experiment which subjected the fish to severe maltreatment did not show an increase in mortality but the results were qualified.

During the second year of the field research, tagging was conducted almost every day for a one month period from two separate tagging sites. The results obtained from the two tagging locations were similar.

Evidence is presented that the behavior of the tagged fish may be modified for a period of at least 48 hours. Even when returns were considered only from locations near the tagging sites, a low rate of return was obtained during the first 48 hours.

A high mortality rate was indicated for fish tagged early in the season prior to the start of the fishing season. After fishing began the tagging indicated relatively uniform mortality rates during the period of study.

The assumptions necessary for successful estimation by means of tag and recapture methods are reviewed and it is pointed out that the estimates should be used as indices until they have been empirically tested.

Methods of calculating mortality rates that consider either returns from one tagging experiment during several recapture periods, or returns from several tagging experiments during one recapture period, are applied. It is recommended that neither method be used to the exclusion of the other. The application of the two methods gave similar results. The estimates of the rate of exploitation indicates that between 42 and 67 per cent of the available tags were taken each fishing period. A measure of the survival of tagged fish indicates that after a period of between three and five days only half of the tags remain in the fishing area.

The average time from tagging to passage through the Karluk weir was about nine days. The tags recaptured at the weir indicated that the average interval between tagging and passage at the weir remained constant during the period of study.

The problems of combining weir or tower counts and catch statistics to obtain total run estimates are discussed. It is pointed out that a total run calculated by this method may be in error under conditions resulting from increases and then decreases in the size of the run.

The tagging estimates are compared to the total run calculated from catch and escapement. There is a close agreement between the estimates and the total run.

Microfilm \$2.45; Xerox \$8.60. 187 pages.

THE BIOLOGY OF THE BLISTER MITES, ERIOPHYES SPP., OF PEAR AND APPLE IN THE PACIFIC NORTHWEST

(L. C. Card No. Mic 59-3402)

Everett C Burts, Ph.D. Oregon State College, 1959

Major Professor: Charles H. Martin

The biology and host specificity of the blister mites of apple and pear were studied in Oregon and Washington during 1957, 1958 and the winter of 1959. Eriophyes pyri is restricted to pear trees. The blister mite of apple differs morphologically and biologically from the mite found on pear and is described as Eriophyes mali new species. The blister mite of mountain ash, formerly included in the E. pyri complex was found to differ from both the blister mite of pear and the blister mite of apple and is described as Eriophyes sorbi new species. In addition to E. pyri, a few specimens of another species, identified by Norton S. Wilson in California to be morphologically similar to the desert peach mite E. prunandersoni, were found in leaf blisters on pear.

The blister mites of pear and apple have similar life cycles involving an egg, two nymphal instars and an adult. The nymphs undergo a short quiescent period just prior to molting. The length of the life cycle is 15 to 20 days during the spring and 10 to 12 days during the warmer part of the summer. During the first generation within the blister, the mite population increases about 50 times.

The life history of the two species of mites of apple and pear is closely correlated in the spring with the development of the host plants and in general, development on apple is 2 to 3 weeks later than that on pear. The blister mites found on apple and pear in the Pacific Northwest pass the winter as adult females. During the winter the mites are in a state of diapause and do not feed or carry on reproductive activities. The mites on pear break diapause in early February; those on apple break diapause about 20 days later. The overwintering mites deposit eggs in the spring and by their feeding on the leaves and blossoms cause the blisters to develop. The first spring generation matures on the young leaves and in the leaf axils. The adults of this generation enter the blisters between full bloom and petal fall. Several generations develop within the blisters during the late spring and summer. On pear, adult mites migrate to the lush growing terminals at intervals when the blister becomes crowded. On these terminals they cause new blisters to develop. Populations

of mites then develop within these new blisters. Blister mites of pear and apple begin moving from blisters to buds to overwinter in July, but the important movement into the buds does not occur until early September. Movement to the buds continues until the infested leaves drop.

Results of wind trapping tests indicate that few blister mites are carried from place to place individually by the wind. The characteristics of spread of the blister mite indicate that they are carried from place to place by insects or other animals. The habits of the green apple aphid seem to be well suited to distributing blister mites. Wind blown infested leaves also are responsible for the distribution of blister mites.

Predators do not materially reduce populations of blister mites in the Pacific Northwest. Typhlodromid mites feed on blister mites, but are unable to penetrate deeply into the blister. They do not occur in populations that would be effective in controlling blister mites.

Microfilm \$2.00; Xerox \$3.00. 52 pages.

### THE BIOLOGY OF THE FILBERT APHID, MYZOCALLIS CORYLI (GOETZE), IN THE CENTRAL WILLAMETTE VALLEY

(L. C. Card No. Mic 59-3403)

Haidar El-Haidari, Ph.D. Oregon State College, 1959

Major Professor: Charles H. Martin

This thesis contains a review of literature regarding distribution, host plants and the taxonomic position of the filbert aphid, Myzocallis coryli (Goetze). In addition, the economic importance and type of damage, descriptions of forms and stages, life cycle and habits were treated extensively from the literature and from the observations of the author.

Life history study in the field indicates that the filbert aphid has 10 generations a year. The length of each generation is influenced by the interaction of temperature and relative humidity.

Factors affecting egg-laying activity were studied in the field. It was found that temperature, relative humidity and whether the tree is dry or wet, influence the activity of egg-laying females and in turn the number of eggs laid. Whether branch is young and smooth or older with rough bark influences oviposition which in turn influences the number of eggs deposited.

A special effort was made to differentiate between the direct effect of light on the appearance of the sexual forms of the aphid and the indirect effect that might be induced by a change in the plant physiology. Shortening the period exposed to light accelerated the appearance of the sexual generation.

The distribution of the filbert aphid on a tree was studied also with regard to leaf age and within single leaves.

An attempt was made to evaluate the effect of aphid injury on the quality of filbert nuts. Nuts taken from infested trees were inferior in appearance to those taken from trees treated with Systox. However, there was no difference between the two groups of nuts with regard to size, weight and fat content.

Microfilm \$2.00; Xerox \$4.20. 79 pages.

EFFECT OF DATE OF PLANTING AND HYBRID RESISTANCE OF FIELD CORN ON EUROPEAN CORN BORER POPULATIONS

(L. C. Card No. Mic 59-3377)

Travis Rex Everett, Ph.D. Iowa State College, 1959

Supervisor: Tom A. Brindley

Results are reported on experiments, conducted in 1957 and 1958 at Ankeny, Iowa, to study first- and second-brood European corn borer [Pyrausta nubilalis (Hübn.)] infestations on Oh43 x Oh51A, a resistant corn hybrid, and the susceptible hybrid, WF9 x M14.

Plant development was followed by periodically measuring plant height, the tassel ratio, and determination of mid-tassel emergence and mid-silking dates each year.

First-brood borer populations originating from natural and manual infestations were determined by periodic dissections throughout the first brood infestation period. Second brood infestations were evaluated by a dissection when the corn was mature.

Corn yields following borer infestations were used to evaluate the association between borer infestation and yields as influenced by hybrids and planting dates.

The resistant hybrid developed more rapidly than the susceptible hybrid; the late planting developed at a faster rate than the early planting, but was more immature at any particular date.

First brood ovipositing moths preferred early planted corn to the smaller, less mature late planting. Attrahent properties of the two hybrids were not consistently different in attracting moths for ovipositing. Second brood moths deposited more eggs on less mature, late planted corn than earlier planted corn, and more on plants that were free of first brood infestation than those that had been severely damaged.

Survival of first brood larvae was adversely affected by the resistance in Oh43 x Oh51A, and development was retarded. Late planting did not markedly affect borer survival but development was slower than in an earlier planting. Effects due to late planting were independent of the presence of or absence of hybrid resistance.

Resistance to larval survival in Oh43 x Oh51A was not as pronounced for second brood as for first brood larvae. In the resistant hybrid, the early and late plantings were equally satisfactory as hosts for second brood larvae in 1957; in 1958 the early planting was more satisfactory. The greatest fall populations each year, were found in the late susceptible planting.

Fall borer populations were more closely associated with the number of second brood egg masses placed on the plants than any intensity of infestation by first-brood borers although larval survival was decreased slightly on plants heavily infested by first-brood borers.

A supplemental experiment showed that the larvae which survived and developed to maturity on Oh43 x Oh51A were not segregates of a strain better adapted for survival on that hybrid.

Evaluations of yield reduction, by borers, showed a variability in the amount of loss per unit of damage (cavity) due to planting date, hybrid, time of infestation (first or second brood) and years. In general, the late planting lost more yield per cavity than the early planting and the susceptible hybrid more than the resistant hybrid.

These experiments support the use of resistant hybrids in control of the corn borer. Late planting cannot be recommended, without reservation, in Central Iowa.

Microfilm \$2.00; Xerox \$6.60. 138 pages.

EUROPEAN CORN BORER CONTROL WITH GRANULAR FORMULATIONS OF ENDRIN, HEPTACHLOR, AND TOXAPHENE

(L. C. Card No. Mic 59-3378)

Mahlon Lowell Fairchild, Ph.D. Iowa State College, 1959

Supervisor: Tom A. Brindley

Experiments were conducted at Ankeny, Iowa from 1956 to 1958 to determine the rates of endrin, heptachlor, and toxaphene in granular formulations adequate to give effective European corn borer (Pyrausta nubilalis [Hbn.]) control. Granular DDT was used as a standard for comparison.

Based on the results obtained in these tests, granular endrin, heptachlor, and toxaphene at 0.2, 0.75, and 1.5 pounds of actual toxicant per acre, respectively, are as effective as granular DDT at 1 pound. Granular DDT at 0.6 pound per acre is insufficient to give satisfactory corn borer control.

Samples of corn plants treated with granular DDT, heptachlor, and toxaphene for borer control were taken to determine the insecticide residues remaining. One day after granular insecticides are applied for first-brood borer control, the greatest amount of residue is found on the spirally rolled leaves of the "whorl." The least residue is found on the tips of the leaves.

The insecticide residue deposits on the plants, one day after treatment, are greater after granules are applied for first brood control than after second brood control. However, at the time the ears are harvested, more residue is found on corn treated for second brood control than on corn treated for first brood control.

At harvest time, the residue deposits after application of 1 pound of DDT and 1.5 pounds of toxaphene for first-brood borer control ranged from 0.4 to 0.7 and 0.9 to 2.1 p.p.m., respectively. The residue deposits following application of the same rates of DDT and toxaphene for second brood control ranged from 0.9 to 5.0 and 1.6 to 8.7 p.p.m., respectively. Less than 0.1 p.p.m. heptachlor residue was found following application of 0.75 pound of heptachlor for first or second brood control. All of these residue deposits are within established tolerances.

Heptachlor is converted to its epoxide on corn plants. These deposits ranged from 0.03 to 0.04 p.p.m. at ear harvest after first brood treatments, while 0.23 p.p.m. was found at ear harvest after application of heptachlor for second brood control.

Microfilm \$2.00; Xerox \$5.40. 107 pages.

THE TOXICITIES OF SEVERAL ROTENONE FORMULATIONS TO NINE SPECIES OF WARM-WATER FISHES

(L. C. Card No. Mic 59-2944)

Francis Eugene Hester II, Ph.D. Alabama Polytechnic Institute, 1959

Supervisors: John S. Dendy and Homer S. Swingle

Experiments were conducted in aquaria in the laboratory and in outdoor concrete ponds to determine the effectiveness of Sulfoxide and piperonyl butoxide as synergists to rotenone for fish poisons. The synergized formulation, were compared to non-synergized formulations containing 5.0 per cent rotenone and to powdered cube. Except for powdered cube, all formulations were in liquid form and contained emulsifiers. The following formulations, designated by their principal toxic components, were tested:

- (1) 5.0 per cent rotenone
- (2) 2.5 per cent rotenone plus 2.5 per cent Sulfoxide
- (3) 2.5 per cent rotenone plus 5.0 per cent Sulfoxide
- (4) 2.6 per cent rotenone plus 7.5 per cent Sulfoxide
- (5) 2.0 per cent rotenone plus 4.0 per cent piperonyl butoxide
- (6) 2.5 per cent rotenone plus 2.5 per cent piperonyl butoxide
- (7) 2.5 per cent rotenone plus 5.0 per cent piperonyl butoxide
- (8) powdered cube (7.3 per cent rotenone).

In the laboratory, the following eight species of fish were used: carp, Cyprinus carpio; largemouth bass, Micropterus salmoides; fathead minnows, Pimephales promelas; goldfish, Carassius auratus; bluegills, Lepomis macrochirus; green sunfish, Lepomis cyanellus; golden shiners, Notemigonus crysoleucas; and speckled bullheads, Ictalurus nebulosus marmoratus. Experiments with gizzard shad, Dorosoma cepedianum, were conducted in concrete ponds.

In laboratory experiments at 70°F., largemouth bass and carp were the most susceptible species, and golden shiners and speckled bullheads were the most resistant, while fathead minnows, green sunfish, goldfish, and bluegills were intermediate in tolerance to the poisons. At 40°F. carp, fathead minnows, and bluegills were killed by smaller concentrations of the poisons than were golden shiners, speckled bullheads, and goldfish.

Water temperature was found to be an important factor in determining the length of time required for a given concentration to kill the fish. When 40°F. tests were continued beyond the 72-hour test period, the kill of goldfish and fathead minnows at the end of 21 days was approximately the same as that at the end of 3 days at 70°F., indicating that these toxicants might give the same results at 40° and 70°F. if given unlimited time, and if the toxicants did not dissipate. When tests were limited to 72 hours, however, 1.3 to 8.0 times as much of each rotenone formulation was required to kill fish at 40°F. as at 70°F.

The formulations containing 5.0 per cent rotenone were more toxic than any of the synergized formulations or powdered cube, with the following exceptions:

(1) Largemouth bass were killed by smaller

- concentrations of all synergized formulations than of 5.0 per cent rotenone formulations or powdered cube.
- (2) In a series of experiments with bluegills using formulations from one company the synergized formulations were more toxic than the one containing 5.0 per cent rotenone, but in another series with similar chemicals the reverse was true.
- (3) Formulations containing 2.6 per cent rotenone plus 7.5 per cent Sulfoxide, and 2.5 per cent rotenone plus 5.0 per cent Sulfoxide were approximately equal in effectiveness to formulations containing 5.0 per cent rotenone when tested against fathead minnows.

With all species, smaller concentrations of rotenone were required to kill fish when the synergists were added. The synergists were most effective against largemouth bass, and least effective against carp.

In tests with speckled bullheads and goldfish, large fish were more resistant than small fish to three rotenone formulations. There appeared to be sufficient differences in the tolerances of the various species and sizes to allow selective poisoning.

The addition of 2.0 p.p.m. of potassium permanganate completely detoxified 1.0 p.p.m. of Pro-Noxfish and 1.0 p.p.m. of Noxfish, but only partially detoxified 1.0 p.p.m. of powdered cube (7.3 per cent rotenone).

Exposure of 4,000 p.p.m. Noxfish in a glass flask to strong sunlight for 3 1/4 hours reduced the toxicity to gold-fish 66 per cent.

Microfilm \$2.00; Xerox \$5.40. 109 pages.

CYTOLOGICAL STUDIES ON THE SUBESOPHAGEAL BODY CELLS AND PERICARDIAL CELLS IN THE GRASSHOPPER, MELANOPLUS DIFFERENTIALIS DIFFERENTIALIS (THOMAS)

(L. C. Card No. Mic 59-3804)

Richard G. Kessel, Ph.D. State University of Iowa, 1959

Co-Chairmen: Professor H. W. Beams Professor E. H. Slifer

Cytological studies were made on the subesophageal body and pericardial cells of embryos and on pericardial cells of nymphs and adults of the grasshopper, Melanoplus differentialis differentialis. The subesophageal body cells are the first cells in the embryo to differentiate structurally. The pericells appear shortly after blastokinesis.

The cytoplasm of both the subesophageal body cells and embryonic pericardial cells, when completely differentiated, contains globules which are similar in their staining reactions, size and appearance in the living embryo to portions of the yolk. Cytochemical tests indicate that the globules are composed principally of protein and lipoprotein. The globules appear to be broken down and released to the outside in a manner resembling intracellular digestion. The process continues at an apparent rapid rate during active development. No indications of

definite periods in embryonic development during which the contents of the cells are released was noted. Variations in structure and in the staining reactions of the subesophageal body and pericardial cells are similar. This suggests that the function of the two is similar prior to hatching. The subesophageal body cells are still present at hatching.

In addition to numerous inclusion bodies and large, heterogeneous vacuoles, the electron microscope reveals the presence of endoplasmic reticulum, mitochondria, infoldings of the cell membrane and numerous submicroscopic vesicles in the subesophageal body cell. Electron micrographs of adult pericardial cells show a prominent system of endoplasmic reticulum, mitochondria, round or oval vacuoles with various amounts of electron dense material, granules of several kinds, Golgi bodies, a complex system of invaginations or infoldings of the cell membrane and numerous submicroscopic vesicles with a close relationship to the cell membrane and vacuoles which was also observed in the subesophageal body cell. In both types of cells, the two (or more) nuclei possess a double nuclear membrane containing pores.

Lipid is present, usually in small quantities, except in the subesophageal body cells during diapause when large amounts accumulate. Various amounts of PAS reactive material were found in both kinds of cells. Negative results were obtained in both cells in tests for uric acid, urates and glycogen. Acid and alkaline phosphatase could not be demonstrated in the subesophageal body cells and the presence of pigment interferes with these tests, as well as that for lipase, in the pericardial cells of adults. Lipase may or may not occur in the subesophageal body cell. Negative results were obtained in tests for cholesterol and peroxidase in pericardial cells of adults. A positive test for melanin was obtained in pericardial cells from all adults and later instar nymphs. Melanin could not be demonstrated in the subesophageal body cell. DNA and RNA are present in various amounts in their usual position in both cells.

Cytological evidence suggests that the activity of the pericardial cell does not closely parallel the molting cycle

Feeding, starvation and injection experiments suggest that the pericardial cells may take in peptides, protein and albuminoids from the hemocoel fluid and subsequently release them in altered form. Some evidence was also obtained that the pericardial cells may take in particles of the fat body during prolonged starvation and that both the subesophageal body cells and embryonic pericardial cells take in particles resembling yolk. Subesophageal body cells and pericardial cells may both play a role in protein and lipoprotein metabolism. It is probable that the pericardial cell tissue in the adult has several functions as does vertebrate liver.

The widespread occurrence of pericardial cells in insects suggests that their function is an important one. In the embryo they do not differentiate until after the closure of the dorsal surface and this occurs during the later stages of embryonic development. The subesophageal body cells on the other hand, which resemble the pericardial cells so closely in their structure, differentiate early. It seems probable that the subesophageal body cells perform a function which is later taken over by the pericardial cells.

Microfilm \$2.00; Xerox \$5.40. 107 pages.

SEASONAL CYCLE IN THE GONADS OF THE WHITE BASS, (ROCCUS CHRYSOPS), IN LAKE TEXOMA, OKLAHOMA

(L. C. Card No. Mic 59-3361)

Earl Buddy Kilpatrick, Ph.D. The University of Oklahoma, 1959

Chairman: Associate Professor Carl D. Riggs

A study was made of the seasonal cycle of the gonads of the white bass, Roccus chrysops, in Lake Texoma, Oklahoma, from June, 1949, to October, 1955. Gill nets were used to collect the majority of the fish. The remaider were taken by angling. Lengths, weights, and the sex of the fish were recorded on standard scale envelopes in which were placed scale samples to be used later for age determination. The gonads were fixed in Bouin's fixative, FAA, or in 10 percent formalin. The gonads were weighed and outline drawings were made to show the seasonal changes in size. Gonad weights were expressed as percentages of body weights to minimize individual variations. Acetocarmine smears were made to determine the histological condition of the gonads.

White bass gonads exhibit a distinct seasonal variation. They have the least size and weight in late April or early May after being depleted during spawning. The testes remain small after spawning until September when an increase in size and weight begins; this increase continues through April. After spawning, the ovaries increase gradually in size from July through September, then rapidly October through April. The ovaries were larger than the testes from fish of the same age. Both ovaries and testes formed a greater percentage of the body weight in older

and larger fish.

Smears showed that spermatogenesis began in September, became very active in October, then continued at this accelerated rate until the time of spawning. Oögenesis began very soon after spawning. At this time, which was at least two months before spermatogenesis began, the rate of division of the oögonia was rapid. The oögonia then increased in size until they reached maturity shortly before spawning. There was no evidence of histological closing of the oviducts of 294 females examined. Study of smears showed that no yearling white bass reached maturity and spawned. Spawning was complete in all but two of 82 mature females examinded during the spawning season.

Microfilm \$2.00; Xerox \$3.00. 52 pages.

## A TAXONOMIC STUDY OF THE HELMINTH PARASITES OF THE TURTLES OF LAKE TEXOMA

(L. C. Card No. Mic 59-2966)

Thomas John McKnight, Ph.D. The University of Oklahoma, 1959

Chairman: Professor J. Teague Self

A taxonomic study of the helminth fauna of six species of aquatic turtles common to Lake Texoma and its Washita tributaries was made. These turtles were Trionyx ferox emoryi. T. spinifera, Pseudemys scripta elegans,

Graptemys pseudogeographica, Kinosternon subrubrum and Chelydra serpentina.

Three species of cestoidea were recovered: Proteocephalus trionyechinum and Cylindrotaenia americana from T. spinifera and T. ferox emoryi; P. testudo and P. scripta elegans and G. pseudogeographica. A complete redescription of P. trionyechinum is given for the purpose of clarifying both the generic and specific positions of this form. Cylindrotaenia americana is reported for the first time from turtles, and P. testudo for the first time from P. scripta elegans and G. pseudogeographica.

Sixteen species of Trematoda were recovered from these hosts. Crepidostomum cooperi is reported for the first time from Chelydra serpentina, this species being originally collected from T. mutica. Cephalogonomus vescaudus was collected from all hosts except C. serpentina; Cotylaspis cokeri, Telorchis erectus, and Vasotrema longitestis from T. ferox emoryi; Telorchis corti, and Vasotrema longitestis from T. spinifera; Polystomoides orbiculare, Spirorchis artericola, T. corti, and T. medius from P. scripta elegans; Spirorchis scripta, T. lobosus from G. pseudogeographica; Aorchus extensus, Polystomoides orbiculare, T. diminutus and T. medius from K. subrubrum; and in addition to Crepidostomum cooperi, T. aculeatus, T. attenuatus, T. clava, T. lobosus, and Dictyangium chelydrae from C. serpentina.

Eight species of nematoda were identified from these hosts. Camallanus trispinosus and Spiroxys contorta were the most widely distributed species. C. trispinosus was recovered from all host species except K. subrubrum, and S. contorta from all except C. serpentina. Oxysomatium veriabilis is reported for the first time from T. spinifera and G. pseudogeographica, it being previously known as a parasite of terrestrial turtles and lizards. Oswaldocruzia leidyi was present in both G. pseudogeographica and T. ferox emoryi. Cucullanus emydis was recovered from T. ferox emoryi, and C. cirratus from K. subrubrum and P. scripta elegans. Spironoura wardi was recovered from G. pseudogeographica and S. chelydrae from C. serpentina.

The low incidence and intensity of trematode infection of the six species of turtles studied seems to be related to the relatively small populations of the mulluscan and arthropod intermediate hosts existant in the lake. Two ecological factors, peculiar to artificial impoundments which are used for flood control and hydroelectric production, seem to be involved in producing conditions which adversely affect the development of normal populations of these intermediate hosts. These conditions are rapidly changing water level which prevents the establishment of a normal flora of aquatic plant life, and high turbidity of the water during the rainy season, accompanied by heavy siltation of the bottom in shoreline areas.

At temperatures from 45° to 50°C these turtles are inactive. Specimens captured during periods of prolonged low temperatures were found to have very little food in the digestive tract. Although some specimens of trematodes and nematodes were recovered from these specimens, no cestodes were present. The lack of cestode infection in these reptiles during periods of inactivity is not surprising, since other workers have also found this condition to exist. It seems probable that physiological changes in the intestinal mucosa produce conditions unsuited to the maintenance of these parasites, during periods of low temperatures.

Microfilm \$2.00; Xerox \$3.00. 55 pages.

THE FISHES OF THE ST. JOHNS RIVER SYSTEM

(L. C. Card No. Mic 59-3559)

William McNair McLane, Ph.D. The University of Florida, 1955

The fishes of the St. Johns River drainage system have been investigated over a period of ten years. One hundred and eighteen forms representing thirty-six families are recorded for the drainage system not including a list of forms which are listed for the mouth region on the basis of literature records.

Acipenser oxyrhynchus, Umbra pygmaea, Notropis sp. A, Ameiurus platycephalus platycephalus, Agonostomus monticola, Acantharchus pomotis, and Etheostoma nigrum olmstedi are recorded for the first time from Florida.

To the published records of marine fishes from freshwater the following are added: Dasyatis hastata, Brevoortia smithi, Membras martinica lacinata, Anchoa mitchilli diaphana, and Diapterus olisthostomus.

Original observations are presented on breeding habits, early life history, food and feeding habits, abundance and habitat requirements, for many of the species in the annotated list.

Data are presented on morphological variation in certain species.

An analysis is presented of the ichthyofauna of the river system in relation to its geographic origin. The distribution of the primary freshwater species in the drainage system is discussed.

The extensive invasion of marine fishes into the freshwaters of the drainage system is analyzed and discussed on the basis of the following categories: migratory, non-migratory, uncertain status, and residual populations.

Continuous and discontinuous distribution of marine fishes in the river in relation to salinities is discussed.

The distribution of freshwater species in relation to the increasing salinities in the mouth region of the river is discussed.

A correlation between the geologic history of the drainage basin and the distribution of marine relics within the present day river system is discussed.

Microfilm \$4.70; Xerox \$15.80. 367 pages.

OF RESISTANCE TO CHEMICALS BY THE HOUSE FLY, MUSCA DOMESTICA L.

(L. C. Card No. Mic 59-3004)

Bernard Lawton Owen, Ph.D. Alabama Polytechnic Institute, 1959

Supervisor: William G. Eden

An investigation was conducted to study the cross tolerance responses of the Orlando laboratory strain of the house fly during selection for resistance to certain toxicants.

Although breeding stock of this strain supposedly had never been exposed to the modern chlorinated hydrocarbon insecticides, the strain had certain properties not possessed by other susceptible fly strains. It had a low tolerance for DDT and TDE, a very high tolerance for dieldrin, and a fairly low tolerance for endrin.

Strains were selected for resistance to TDE and DDT by introducing these chemicals into the larval medium. The susceptibility of each strain to the toxicant for which resistance was being developed was determined at frequent intervals, usually every second or third generation. At less frequent intervals, usually every fifth or sixth generation, the cross tolerance of the strain to other toxicants was determined. Insecticides used were DDT and TDE, representing the diphenyl ethane compounds, and dieldrin and endrin, representing the cyclodiene insecticides. Response to toxicants was determined by topical application of the chemicals. There was a very rapid increase in tolerance to the toxicant for which resistance was being developed. The rapid initial increase in susceptibility to DDT was followed by a somewhat slower rate of increase in tolerance to the toxicant in succeeding generations. A plateau of resistance was reached which did not appreciably increase in subsequent generations, although the amount of DDT added to the larval medium was increased. The change in response to TDE was similar to the change in susceptibility to DDT.

The response of flies of the DDT-strain to endrin and dieldrin during successive generations of selection for resistance to DDT was very similar. The response of the strain to these two compounds was quite different, however, to the response to TDE and DDT. There was no great increase in tolerance to endrin and dieldrin as the strain became more resistant to DDT and TDE.

The change in tolerance to TDE during successive generations of the strain being selected for resistance to TDE was closely related to the response of the DDT strain to TDE during selection for DDT resistance. A level of resistance was attained which did not significantly change in subsequent generations, although the amount of TDE added to the larval medium was increased.

The change in tolerance to DDT by the TDE strain proceeded in a manner similar to the change in tolerance to TDE. The response to endrin by the TDE strain was similar to that of the DDT strain. The response of the TDE strain to dieldrin did not resemble that of the DDT strain to the toxicant, or the response of either strain to any of the other insecticides. A slight initial increase in tolerance to dieldrin was followed by a considerable increase in susceptibility to that chemical. There was no great change in tolerance to dieldrin subsequent to the eleventh generation of selection to TDE.

Microfilm \$2.45; Xerox \$8.40. 185 pages.

A LIFE-HISTORY STUDY OF THE TUFTED TITMOUSE, Parus bicolor Linnaeus

(L. C. Card No. Mic 59-2645)

William Percival Pielou, Ph.D. Michigan State University, 1957

Major Professor: George J. Wallace

A life-history study of the Tufted Titmouse, <u>Parus</u> bicolor, was the object of investigation from September 1953 to September 1955. The study is presented in two

parts: (1) classification, nomenclature, and distribution; (2) observations on the annual cycle. The information in Part I was based on a review of the literature and extensive correspondence. The mapping of the distribution of the Tufted Titmouse in Michigan is based in part on the author's own observations but mainly on correspondence with ornithologists throughout the state.

The data presented in Part II were gained largely from field observations in three woodlots on the property of Michigan State University, East Lansing, Michigan. This was the principal objective of the research and included a study of: (1) the nesting cycle, from the time of pairing and separation of birds from the winter flocks to the dispersal of juveniles and formation of the fall flocks; (2) ecological relationships; (3) flock composition and behavior; (4) voice; (5) roosting; (6) food and feeding habits, based on stomach analyses and field observations.

Nesting Cycle. Pair formation, and separation of birds from the winter flocks, occurred in late March and early April. Nest construction, which was the duty of the female, began several days after pairing. Territory establishment seemed to coincide with nest construction. The male defended the territory until the young left the nest.

All nests were located in abandoned woodpecker holes or natural cavities in living deciduous trees. The average height of twenty nests was 38.5 feet. The loosely constructed nests all contained dried grass, moss, and hair, and often other miscellaneous items.

First eggs were laid from May 4 to May 11, and the eggs were deposited at the rate of one a day until the full complement of five or six was reached. Copulation was observed only during this period. Incubation was performed solely by the female and she was fed during both her attentive and inattentive periods by the male. Incubation lasted approximately thirteen days.

Hatching brought about a shift of the male's feeding attention from his mate to the young. The rate of feeding the young by both parents gradually increased until the young left the nest, fifteen days after hatching.

The young remained with their parents at least several days and in some cases the family group formed the nucleus of fall flocks.

Flocking. Flocks of titmice and associated species began forming as early as August. The size of the flock was variable but averaged seven birds. During their feeding excursions in the fall the titmouse groups were enlarged with migrant birds, especially warblers.

Voice. Of its variable repetoire the Tufted Titmouse's most commonly heard and characteristic song is the "peto, peto" expression. In addition it has a location note, alarm note, recognition note, hissing note, invitational note, begging note, and distress note.

Roosting. Roosting occurred in evergreen and deciduous trees and the birds roosted wherever they happened to be at sundown during the fall and winter. During the nesting cycle the female slept in the nest cavity while the male roosted nearby.

Food and Feeding Habits. Tufted Titmice consume two-thirds animal matter and one-third vegetable matter annually. Food was secured from the ground litter to the uppermost twigs of the tallest trees. Insects were gleaned mostly from the bark and leaves but hawking of insects was noted on one occasion.

Microfilm \$2.00; Xerox \$5.60. 111 pages.

ADRENAL CORTICAL FUNCTION DURING PREGNANCY AND LACTATION IN THE MOUSE, REFLECTED BY THE CIRCULATING EOSINOPHILS

(L. C. Card No. Mic 59-3224)

Kenneth Edward Shaw, Ph.D. The University of Wisconsin, 1959

Supervisor: Professor Roland K. Meyer

A general interest in the adrenal cortical hormones, particularly their secretion during pregnancy and lactation, was the starting point of the investigation to be described. The diurnal corticoid secretion pattern in non-pregnant mice, reflected by the changes in circulating eosinophils, was established for comparison with the diurnal pregnancy and lactation corticoid patterns. After the pregnancy and lactation patterns were observed, studies were made of some adrenal-like hormone secretion sites at these times.

A routine procedure of serial 3-day eosinophil counts, using the method of Speirs and Meyer, was established for sampling at the times of relatively high eosinophil (low corticoid) values at 8 A.M. and the low eosinophil (high corticoid) levels at 10 P.M. Successive diurnal eosinophil determinations were obtained over a 45-day period. The mice were ovariectomized or adrenal-ectomized in a one-step operation and no serial eosinophil counts were obtained until at least 2 days post-operation. A statistically significant difference was seen between the morning and evening corticoid secretion patterns. The stress of handling caused increased cortical secretion in the morning but the evening levels were not significantly affected.

The first three morning eosinophil counts in ovariectomized mice showed a response to the stress of surgery and handling but then recovered and remained at the normal morning levels. The initial evening eosinophil count in ovariectomized mice showed a loss of the diurnal rhythm, and then returned to the levels seen in normal mice in the morning. The response suggested an interaction of the longer estrous cycle with the diurnal adrenal cycle.

During pregnancy, the diurnal corticoid rhythm, reflected by the circulating eosinophils, was lost and replaced by progressively increased corticoid secretion which reached a maximum at parturition. The diurnal corticoid secretion remained high during lactation until weaning, but after weaning the diurnal corticoid levels returned to the low morning levels.

The pregnancy and lactation cortical secretion patterns were repeated in subsequent pregnancies and lactations in the same animals mated after weaning. In mice remated at post-partum estrus, the first lactation cortical secretion pattern was the same, but after weaning the corticoid levels returned to the morning control values and remained there throughout the second pregnancies and lactations. During the last third of pregnancy, the mice showed cross-resistance to the stressor, cold.

Investigations of potential corticoid sources during pregnancy, suggest that the ovary and fetal adrenals secrete little, if any, cortical hormones. The maternal adrenal secreted throughout pregnancy, and by elimination, the placenta was indicated as the other important source of cortical hormones.

The lactation eosinopenia was the same if 5 or 10 pups provided the sucking stimulus, but animals with a minimal sucking stimulus returned to cyclic estrus and lost the lactation eosinopenia.

The lactation eosinopenia was not observed after ovariectomy, although the litters were raised. Daily exogenous estradiol 17-beta or progesterone during lactation, after ovariectomy, did not lower the eosinophil levels to those observed during normal lactation. The loss of the lactation eosinopenia, observed with a minimal sucking stimulus, could be reversed by raising the litter to five. This suggested that functional corpora lutea, along with a sufficient sucking stimulus, were necessary to maintain the lactation eosinopenia. The limited lactation obtained with minimal corticoid therapy, which maintained functional corpora lutea, suggested that the corpora lutea do not contribute corticoids directly, but probably act indirectly through the pituitary.

Microfilm \$2.00; Xerox \$5.00. 97 pages.

BIOLOGY AND EVALUATION OF CERTAIN PREDATORS OF THE SPOTTED ALFALFA APHID THERIOAPHIS MACULATA (BUCKTON)

(L. C. Card No. Mic 59-3001)

Robert Gene Simpson, Ph.D. Kansas State University, 1959

The spotted alfalfa aphid, <u>Therioaphis</u> <u>maculata</u> (Buckton), has become the most important pest of alfalfa, although established in the United States only since late 1953. Little is known concerning insect predation on this aphid either in its native habitat in the Middle and Far East nor in the New World.

The common native predators in the Manhattan, Kansas, area were investigated to determine the beneficial effects. Predators' eggs were reared to the adult stage to obtain length of various life history stages. Daily average consumption of each species was determined by feeding the predators aphids in large numbers during the various immature stages and in most cases during the adult stage. Predator field populations were recorded by surveys made during 1957 and 1958 in the Manhattan area.

Six species of coccinellids studied were: Coleomegilla maculata lengi Timberlake; Cycloneda munda (Say); Hippodamia convergens G.-M.; H. glacialis glacialis (Fab.); H. parenthesis (Say); and Olla abdominalis (Say).

Biology studies of these species showed that development from the egg to adult emergence of all species ranged from 15.00 to 18.15 days. Hippodamia convergens G.-M. larvae consumed the highest daily average of 44.99 large aphids. Adults of H. glacialis at the highest average number of 122.06 aphids per day. Females consumed more aphids than did males in warm weather. The influence of cold weather on predator feeding was investigated. Daily consumption by all species averaged 64 large aphids at 75 and decreased to less than one per day at an average temperature of 45 F.

Chrysopa oculata Say and C. plorabunds Fitch averaged 26.0 and 22.4 days, respectively, from egg to adult emergence. Larvae of both species consumed an average number of about 33 large aphids per day. Nabis ferus (Linn.)

required 32.63 days for development of egg to adult. Fifth instar nymphs ate almost the same number of aphids as adults. The life history of Allograpta obliqua Say was 17.50 days in development and the larvae consumed an average of 33.23 large aphids daily. Orius insidiosus (Say) averaged almost 15 days for development and averaged 5.35 aphids per day, the least number of all species.

A theoretical evaluation of aphid predators was obtained by multiplying the seasonal average number occurring in the field times the daily average consumption of each species. The adults of H. convergens proved to be the most important of the coccinellids as well as all insects studied. Nabids, as a group, were second in effectiveness. Chrysopids, anthocorids, and syrphids were the next most efficient in that order. Low field population was the primary reason for the lack of efficiency of the latter groups.

The problem of accurately evaluating native predators for control of the spotted alfalfa aphid is complex. The preference of food hosts by the predator must be more thoroughly investigated before the true value of the predators can be ascertained.

Microfilm \$2.00; Xerox \$4.00. 74 pages.

PLANT PARASITIC NEMATODE POPULATIONS
OF SOME FLORIDA SOILS UNDER CULTIVATED
AND NATURAL CONDITIONS

(L. C. Card No. Mic 59-3556)

Walter Hendrix Thames, Jr., Ph.D. The University of Florida, 1959

The species of plant parasitic nematodes present in 762 samples of soil from 31 soil series occurring in Florida were determined. Of these samples a total of 569 were obtained from sandy soils, 80 from loamy sands, and 113 from sandy loams. Sites sampled included 68 from cultivated and 35 from uncultivated soils.

A total of 48 species were found on cultivated soils. Thirty-seven of these were also present in uncultivated (virgin) soils. One new species, Hoplolaimus gadsdenensis, was described from uncultivated soil in Gadsden County.

The predominant genera found were: <u>Criconemoides</u>, present in 41.3 percent of the samples, <u>Hoplolaimus</u>, present in 39.3, <u>Trichodorus</u>, in 38.5, <u>Belonolaimus</u> in 30.8, <u>Pratylenchus</u> in 28.5, <u>Helicotylenchus</u> in 26.4, and <u>Xiphinema</u> in 21.2.

Species of Hemicycliophora were found in 6.7 percent of the samples, Meloidogyne in 5.8, Tylenchorhynchus in 4.2, Trophotylenchulus in 3.4, and Longidorus in 3.2. Specimens of the genus Paratylenchus were found in only four samples, all from uncultivated soils.

Plant parasitic nematode distribution was not found to be correlated with any of the soils series examined. There was no evidence of a nematode fauna characteristic of any series.

The percent occurrence of the predominant genera from sands, loamy sands, and sandy loams was tabulated. From this it appeared that Belonolaimus was restricted to soils of coarser textures. Specimens of this genus were found in 41 percent of the samples from sands,

5 percent of those from loamy sands, and in none from sandy loams.

The effect of soil texture on survival of Belonolaimus longicaudatus was tested in a greenhouse trial. Mixtures of soils to give clay contents of 3.2, 14.7, 29.2, and 41.2 percent by weight, together with samples of Everglades peaty muck and Flamingo silty clay, were placed in 6 inch clay pots in four replicates and planted to Dixie Hybrid sweet corn. Each pot was inoculated with 100 females and 10 males of Belonolaimus longicaudatus on October 9, 1958. On November 28 nematodes were extracted from the pots by the Seinhorst elutriator technique. The average number of Belonolaimus recovered were as follows: (1) from Arredondo subsoil containing 3.2 percent clay, 322.2, (2) from mixed soil containing 14.7 percent clay, 52.5, (3) from mixed soil containing 29.2 percent clay, 15.0, (4) from a Greenville subsoil containing 41.2 percent clay, 9.0. An average of 16.7 nematodes were recovered from the Everglades peaty muck and only 0.5 from the Flamingo silty clay, a marl soil which contained 6.4 percent sand, 51.4 percent silt, and 42.2 percent clay.

It was postulated that <u>Belonolaimus</u> was unable to maintain population levels in fine textured soils because movement was inhibited.

Microfilm \$2.55; Xerox \$8.80. 193 pages.

A CONTRIBUTION TO A REVISION OF THE CULICIDAE OF NORTHERN THAILAND (DIPTERA: CULICIDAE)

(L. C. Card No. Mic 59-2540)

Ernestine Hogan Basham Thurman, Ph.D. University of Maryland, 1958

Supervisor: Dr. William E. Bickley

This thesis constitutes a systematic treatment of 11 genera of the 17 genera of mosquitoes known to occur in N. Thailand. Seventy species and subspecies are considered of which 10 have been reported in the Thai fauna but have not been collected in the northern provinces to date. Six of the 10 are expected to occur to N. Thailand, based on known distribution in surrounding countries, and 4 are possibly confined to S. Thailand. The geographic area with which this study deals is composed of seven provinces in the Northern Region of the country: Chiengmai, Chiengrai, Lampoon, Lampang, Nan, Prae, and Tak.

The systematic treatment consists of: Complete synonymy of the genera, subgenera, and species; notes on the taxonomic status of the taxa; descriptions of new taxa; descriptions or illustrations of previously undescribed stages of known species; salient characters of previously described taxa; notes on bionomics and public health importance; new occurrence and distribution records; illustrations; and keys.

One subgenus and 14 species are described. Two undescribed species are discussed but not named. Six additional groups of females are mentioned. These are not named inasmuch as they are in a genus (Topomyia) which is based primarily on characters of the males; however, they probably represent new species. Two taxa are

elevated from subspecific or varietal status to specific rank. Six new occurrence records, 2 species described during 1958, and 14 new species are included, increasing the known fauna by 24 specific taxa. The known fauna in 1957 totaled 231 species and subspecies; the current total is 255 specific taxa.

Illustrations consist of 6 diagrams of chaetotaxy and morphology, structures of the male terminalia of 43 of the 70 species, and structures of the immature stages of

7 species.

After the name of each genus in the following list is given first, the number of valid species treated and second, the number of the new species described (if any):

Toxorhynchites - 9, 3; Topomyia - 8, 8 (and 1 subgenus);

Malaya - 2; Hodgesia - 2, 1; Orthopodomyia - 5, 1;

Aedeomyia - 1; Heizmannia - 10, 1; Ayurakitia - 1;

Udaya - 1; Armigeres - 22. The total number of instances of new synonymy is 12 reported in 3 genera: Malaya,

Heizmannia, and Armigeres. Five emendations are listed in Tripteroides and Topomyia and three names are designated as nomina dubia in Armigeres. One name among the nomina dubia is also a junior primary homonym.

Keys for as many stages as possible are presented to the subfamilies, tribes, genera, and species included in this study. Appended are keys to the adults, male terminalia, pupae, and larvae of all the genera known to occur

in Thailand.

In the fauna there are 17 species recognized as vectors for either dengue, filariasis, or malaria in Thailand; there are 39 other species present in the nation which are natural or experimental vectors in other areas for dengue, filariasis, malaria, the encephalitides, or yellow fever. These 39 species are significant as potential vectors in the Thai programs directed toward the control or eradication of mosquito-borne diseases of man. Appended are lists of the mosquito species which are currently recognized in the fauna of Thailand and the mosquito-borne diseases of man with the vector and potential vector species of Thailand which are significant to civilian and military agencies in Southeast Asia.

Microfilm \$4.75; Xerox \$16.00. 372 pages.

STUDIES ON GROWTH MEASUREMENT AND EVIDENCE FOR A POSSIBLE CARBON DIOXIDE REQUIREMENT IN TETRAHYMENA PYRIFORMIS W.

(L. C. Card No. Mic 59-2653)

Claude Alton Welch, Ph.D. Michigan State University, 1957

Major Professor: R. A. Fennell

This investigation was undertaken in order to reevaluate several of the growth measuring devices used in microbiology and to utilize the findings in an attempt to examine the problem of carbon dioxide fixation in the protozoan, Tetrahymena.

Cultures of Tetrahymena pyriformis W were grown in several types of bactone and chemically defined media. In some cases, growth of the populations was estimated by optical density (Klett-Summerson photometer), direct

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cell count (Sedgewick-Rafter chamber) and dry-weight determinations. Direct cell counts were also made on clone cultures grown in Van Tieghem chambers. In some cases the Van Tieghem chambers contained isosmotic solutions of either KOH, KCl or Na acetate as moisteners. The KOH was used to absorb carbon dioxide from the sealed chamber; isosmotic solutions of KCl or Na acetate were used as controls. A modified Van Tieghem chamber was constructed by soldering two small brass tubes into holes drilled into the opposite sides of the brass ring portion of the chamber. With suitable connections attached to the brass tubes, a constant flow of air can be drawn through the chamber; this permits one to control the gaseous environment of the culture.

Optical density measurements were not well correlated to either the direct cell counts or the estimated total mean protoplasmic area. No attempt was made to measure changes in the opacity of cells. Optical density measurements taken on the supernatant of the culture media showed a gradual increase in optical density. The increase in optical density, however, was not proportional to the number of cells. In fact, the supernatant of a culture grown in a bactone enriched (yeast extract) medium gave a lower optical density than a non-enriched bactone culture supernatant even though the maximum growth (cell count) in the enriched medium was three times as high as the non-enriched medium. Neither the red, green nor blue filter was affective in negating the optical density change which occurred in the supernatant. The supernatant of the

chemically defined medium, compared to the bactone media, showed a slower and smaller change in its optical density. It is recommended that the supernatant of the culture medium be used as the standardization medium for optical density measurements. At least, it seems advisable to continually check the optical density of the supernatant for possible variation. Optical density changes which may occur in the supernatant not only can produce inaccurate growth measurements, but may provide helpful information concerning metabolism.

Good growth curves were obtained from clone cultures grown in the Van Tieghem chambers. This culture method gives accurate cell counts of live cells during the important early phases of the growth curve. Accurate cell counts can be made at maximum growth by photomicrography

(Kodak XXX, 1/1000 seconds).

Growth of <u>Tetrahymena</u> was not suppressed when CO<sub>2</sub>-free air was bubbled through the culture tubes. This confirms earlier investigations. However, a reduced growth rate was produced in Van Tieghem chambers containing 0.3 molal KOH. More consistent results were obtained when CO<sub>2</sub>-free air was passed through Van Tieghem chambers containing single organisms in chemically defined medium.

Attempts to substitute various carboxylic acids (malic, succinic, fumaric, aspartic, alpha ketoglutaric) for this possible carbon dioxide requirement were unsuccessful. Tests were not made to ascertain whether or not these acids were able to penetrate the cell membrane.

Microfilm \$2.05; Xerox \$7.40. 156 pages.

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